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RESEARCH INSTITUTE, NEW DELHI.

PERFUMES, COSMETICS AND SOAPS

UNIFORM WITH THIS VOLUME

PERFUMES, COSMETICS AND SOAPS

With Special Reference to Synthetics

BY W. A. POUCHER, PH.C.

VOLUME TWO

SIXTH EDITION

*Being a Treatise on the Production, Manufacture, and
Application of Perfumes of all Types*

CONTENTS:—Historical Sketch; The Production of Natural Perfumes; The Purchase and Use of Flower Absolutes; Odour Classification; Fixation and Blending; Monographs on Flower Perfumes; Miscellaneous Fancy Perfumes; Toilet Waters; Soap Perfumery; Tobacco Flavours; Floral Cachous; Incense and Fumigants; Sachets and Solid Perfumes; Fruit Flavours; Appendix; Index.

VOLUME THREE

SIXTH EDITION

Being a Treatise on Modern Cosmetics

CONTENTS:—Bath Preparations; Dental Preparations; Hair Preparations; Hair Dyes; Lip-Sticks; Manicure Preparations; Rouge and Eye Cosmetics; Shaving Preparations; Skin Creams and Lotions; Smelling Salts; Sunburn Preparations; Theatrical Requisites; Toilet Powders; Appendix; Index.

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PERFUMES, COSMETICS AND SOAPS

With Special Reference to
SYNTHETICS

By
WILLIAM A. POUCHER
PH.C.

Volume One

BEING A DICTIONARY OF RAW MATERIALS
TOGETHER WITH AN ACCOUNT OF THE
NOMENCLATURE OF SYNTHETICS

Fifth Edition



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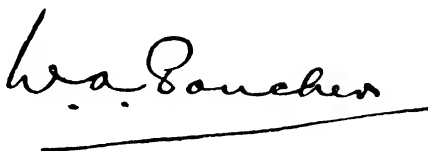
AUTHOR'S PREFACE TO THE FIFTH EDITION

SINCE the appearance of the last edition of this work, a relatively large amount of research has been devoted to cosmetic chemicals, of which I have cited some twenty-three new substances in this volume. The number of available aromatic chemical bodies was already extensive, and although numerous new synthetics were kindly sent to me by manufacturers in Europe and America, I have only included six of them as being of especial interest. I have added notes on eight new volatile oils.

Following my visit to Calabria and Sicily, where I had every opportunity of studying the production of the Citrus oils, I have given a concise account of both Bergamot and Lemon which I hope will do much to clear up many obscure points relative to them.

The resuscitation of the English Lavender industry, with which I have been directly associated for some years in Norfolk, has received more detailed treatment. I believe the data and photographs included will satisfy many of the enquiries frequently sent to me.

The present scarcity of certain perfumery raw materials due to the war has created a situation which calls for great ingenuity on the part of chemists who must find substitutes if business is to be carried on. I trust this volume will be of some use in facilitating the solution of these difficult problems.



40 PICCADILLY,
LONDON, W. 1,
May, 1941.

CONTENTS

	PAGE
A DICTIONARY OF THE RAW MATERIALS OF PERFUMERY, TOGETHER WITH FORMULÆ FOR SYNTHETICS AND THEIR PHYSICAL CONSTANTS	3
APPENDIX I.	
NOMENCLATURE OF SYNTHETICS	43I
APPENDIX II.	
DETERMINATION OF PHYSICAL CONSTANTS.	45I
APPENDIX III.	
CONVERSION TABLE AND DATA	454
APPENDIX IV.	
STANDARD PACKAGES	459

LIST OF ILLUSTRATIONS

1. Cuttle-Fish Beaks found in Ambergris . . .	<i>Facing page</i> 26
2. Lump of Ambergris weighing 184 pounds . . .	27
3. Ambergris from the Bowel of Sperm Whale . . .	28
4. Bergamots arriving at a Calabrian Factory . . .	70
5. Cultures of Broom	82
6. Field of English Camomile	90
7. The Canadian Beaver	106
8. The Civet Cat	126
9. Collecting Civet	127
10. English Clary Sage growing at Heacham . . .	130
11. Manufacture of Pomades (Enfleurage) . . .	165
12. Field of French Geranium	188
13. Algerian Geranium at Boufarik	189
14. Cultivated Hyacinths	209
15. Field of Jasmin	226
16. Jonquilles	228
17. Flowers of <i>Cistus ladaniferus</i>	234
18. <i>Cistus ladaniferus</i> growing in the Esterel . . .	235
19. Harvesting English Lavender	237
20. Dwarf Munstead Lavender	238
21. Giant Blue Lavender	239
22. Distillery at Fring	240
23. Oil Receiver	241
24. Cultivated French Lavender	242
25. Wild French Lavender	243
26. Sicilian Lemon Trees	248
27. Mal-secco Disease	249
28. Stock of Lemons	250
29. Sponge Process	251
30. The Male Musk Deer	282

31. Tonquin Musk Packages	<i>Facing page</i>	283
32. Musk Pods—actual size	„	284
33. Musk being grained	„	285
34. Chinese Sounding Linker	„	286
35 and 36. The above in use	„	287
37. Orange Trees	„	310
38. Orris Stills	„	316
39. Crop of English Peppermint	„	326
40. Field of Roses near Grasse	„	356
41. Field of English Rosemary	„	357
42. Rose Otto Distillation—Modern Fire Stills	„	358
43. „ „ „ —Stills at Kalofer	„	359
44. Gathering Tuberose	„	406
45. Bourbon Vanilla	„	412
46. Young Verbena Plants	„	416
47. Violets	„	420
48. Melting-point Apparatus	<i>Page</i>	451
49. Boiling-point Apparatus	„	452
50. Specific Gravity Bottle	„	453

VOLUME I

A DICTIONARY

OF THE RAW MATERIALS OF PERFUMERY, TOGETHER
WITH FORMULÆ FOR SYNTHETICS AND
THEIR PHYSICAL CONSTANTS

PERFUMES, COSMETICS AND SOAPS.

Abies Oils—*see* under Pine Needle Oils.

Abir is an aromatic powder containing curcuma, cardamoms, cloves, santal wood, etc., used by the Hindus.

Absinthe Oil—*see* Wormwood.

Absolutes are flower products of maximum concentration, and represent the whole of the perfume without natural waxes, etc. The general method of preparation is as follows: the flowers are extracted by means of petroleum ether or other volatile solvent, in a closed apparatus. These are placed in series and the solvent runs through, finally reaching a vacuum still where it is distilled off at a low pressure and returned to the solvent tank to be used again. The product left behind in the retort consists of the perfume together with the natural and insoluble vegetable wax and pigments, and is known as **Concrete**. The concretes are shaken in special machines with strong alcohol and the insoluble wax separated. The alcoholic solution is then cooled to below zero with the separation of any dissolved wax, this being removed by filtration. The isolation of the perfume from this filtered alcoholic solution is a delicate and difficult matter as high temperatures have a deleterious influence on the odour. It is accomplished, however, by distillation at a low temperature *in vacuo* when the absolute essence is left behind in the retort. The addition of brine solution to the alcoholic extract will cause the separation of the absolute, which may be skimmed off as it rises to the surface, but this method is not now much employed. These products are the so-called absolutes, and, as may be expected, are most

expensive. As a rule they are more or less coloured liquids, and a recent development is their presentation in a colourless form. The process is a secret one, but the elimination of the colour is effected by physical and not chemical means at that stage where the preparation of absolute from concrete commences. The resulting colourless absolutes are very fine products indeed, and are known as "Absoluols," "S.I.S.," "Integral Essences," etc. For a detailed description of the process, with illustrations, *see* Volume II.

Acacia is the name of an extensive genus of trees and shrubs of the *Mimosa* section of the N.O. Leguminosæ, varying in habit from furze-like bushes to lofty trees. The acacia perfumes of commerce are based upon the odour of *Robinia pseudacacia* and are usually mixtures of synthetics such as anisic aldehyde, methyl anthranilate, iso-butyl benzoate, phenylacetic aldehyde, etc. For formulæ and further details, reference should be made to the monograph in Volume II.

Acacia Farnesiana is the source of **Cassie** (*which see*).

Acacia Gum, known also as Gum Senegal or Gum Arabic, is a plant exudation from *Acacia Senegal*, Willd., and other species of the N.O. Leguminosæ, trees indigenous to Northern Africa. The gum exudes after incision of the bark and hardens on exposure to the air. The best kind is collected in Kordofan. It is used in the preparation of liquid kohol - *see* Volume II.

Acaciol is a condensation product of methyl anthranilate with anisic aldehyde. It is a white crystalline powder having an intense odour of *Robinia pseudacacia*. It has the formula $\text{CH}_3 \cdot \text{COO} \cdot \text{C}_6\text{H}_4 \cdot \text{N} : \text{CH} \cdot \text{C}_6\text{H}_4 \cdot \text{O} \cdot \text{CH}_3$ —*see also Schiff Bases*.

Acetanilide is prepared from aniline by the action of glacial acetic acid and occurs in odourless crystals melting at 113°C . and boiling at 304°C . It is known also as Phenylacetamide and Antifebrin. The formula is $\text{C}_6\text{H}_5 \cdot \text{NH} \cdot \text{COCH}_3$. Aqueous solutions have been used

as a liquid face powder, the water on evaporation leaving minute crystals deposited in the pores of the epidermis. The effect is peach-like. Compare also Antipyrine.

Acetanisol—see Methoxy Acetophenone.

Aceteugenol is a substance melting at 29°C ., and possessing an odour reminiscent of clove pinks. Obtained by the action of acetic anhydride on eugenol it has the formula $\text{C}_{12}\text{H}_{14}\text{O}_3$. Aceteugenol has been shown by E. Erdmann¹ to occur in traces in clove oil. It is sometimes employed in the compounding of carnation perfumes. Aceteugenol is known also as eugenyl acetate.

Acetic Acid is produced by the destructive distillation of wood or synthetically by the oxidation of alcohol. In the former three fractions come over during the process :—

1. Gases which are not condensed, such as methane, etc.
2. Pyroligneous acid. •
3. Tar—the source of creosote.

The second fraction contains acetic acid which is fixed by means of lime, the tar separated and the residue distilled. *Wood naphtha* comes over and leaves behind an impure calcium acetate. The acetic acid is obtained from this residue by distillation with hydrochloric acid. It should be water-white and free from empyreumatic matter. The formula is CH_3COOH .

In the production of vinegar, the oxidation of the ethyl alcohol into acetic acid is accomplished by an enzyme *Mycoderma aceti*, which derives the oxygen for the purpose from the atmosphere.

Acetic acid is generally sold containing 33 per cent of real acid. Glacial **Acetic Acid** is preferred by some perfumers who dilute it to the strength required. This substance is obtained by the distillation of dried sodium or calcium acetate with sulphuric acid. The distillate should contain 98.9 per cent by weight of real acetic acid. A point which should be noted is that on the addition of water the specific gravity increases from 1.058 to 1.075 when the mixture contains 77 per cent of acid. The

¹ "Journ. fur prakt. Chem.," 56, 143-156.

further addition of water brings the gravity down until at 46 per cent real acid it has the same specific gravity as the original glaciale. Continued dilution with water causes the specific gravity to decrease. Acetic acid is used in the preparation of some smelling salts, and toilet vinegar when it is mixed with various essential oils.

Acetic Ether—see Ethyl Acetate.

Acetin is either the mono-, di- or tri- acetyl derivative of glycerine. It is used as a solvent, being miscible in all proportions with 45 per cent alcohol, and has also been found as an adulterant of essential oils. Mono-acetin has a specific gravity of 1.20; di-acetin has a specific gravity of 1.19 and a boiling-point about 285° C.; tri-acetin has a specific gravity of 1.165 and boils about 258° C. This latter is a good diluent for artificial flower oils and an excellent plasticiser for cellulose lacquers.

Acetisoeugenol, $C_{12}H_{14}O_3$, is a white crystalline body melting about 80° C., and having a clove-like odour. The specific gravity is 1.087 and the boiling-point 282° C. It is useful in small quantities in carnation perfumes, and has been found as an impurity in vanillin. It is known also as iso-eugenyl acetate.

Acetonaphthone—see Methyl Naphthyl Ketone.

Acetone or di-methyl ketone, $CH_3 \cdot CO \cdot CH_3$, is prepared by the dry distillation of calcium acetate. It is a colourless volatile liquid having a peculiar characteristic odour. It is useful as a solvent for celluloid and nitro cotton in the preparation of nail varnishes. Acetone has a specific gravity of .796 to .801 and boils at 55° to 60° C.

Acetophenone, $C_6H_5 \cdot CO \cdot CH_3$, when absolutely pure, is a crystalline solid melting about 20° C., but as met with in commerce it is usually liquid on account of the presence of traces of impurities. It has a specific gravity of 1.030-1.033 and boils at 201° C. It occurs naturally in the oils of labdanum resin,¹ and *Stirlingia Latifolia*, Stend,² but

¹ Isolated by H. Masson, "Comptes Rendus," 154 (1912), 517.

² "Bulletin Imperial Institute," 21 (1923), 320.

may be prepared synthetically by distilling together calcium benzoate and acetate. Acetophenone is phenyl-methyl ketone, and is used medicinally as **Hypnone**. It is a fragrant body, and may be used with good results in the preparation of hawthorn, mimosa and *foin coupé* perfumes, and also in toilet soaps (traces). It blends well with anisic aldehyde, terpineol, and heliotropin.

An example of its use in artificial hawthorn is appended :—

30	Acetophenone.
200	Anisic aldehyde.
400	Rhodinol.
2	Benzaldehyde.
70	Methyl ionone.
100	Petitgrain oil—French.
50	Mimosa absolute.
50	Rose centifolia.
80	Benzoin R.
18	Musk ambrette.
<u>1000</u>	

Acetum Cantharidini is a pharmacopœia preparation of the following formula :—

Cantharidin	1 gram
Acid acetic glaciale	200 c.c.
„ „ to produce	2000 „

It is occasionally used in hair preparations.

Achillea Millefolium—*see* Milfoil Oil.

Achillea Moschata—*see* Iva Oil.

Acorus Calamus—*see* Calamus Oil.

Activated Carbon occurs in granular, powder and paste forms. It is used for the purification and decolorisation of alcohol, glycerine, citric acid, mineral and fixed oils, etc., and also for the recovery of volatile solvents. Its use in the extraction of flower odours and in conjunction with Silica Gel is covered by a patent, details of which appeared in a well-known perfumery paper.¹

¹ "P. and E.O.R.," September (1931), 312; December (1931), 404.

Activated carbon has also the remarkable attribute of selectively absorbing vapours or gases. This property is utilised for the cleansing of air in industrial neighbourhoods. Olfactic examination of materials is thus facilitated if the air entering the room is first passed through a column of carbon.

Adeps—*see* Lard.

Adiantum Amabile, or scented maidenhair, is, according to D. McDonald,¹ an elegant stove fern from Brazil, with fronds gracefully curved ; in a young state they are slightly scented. This is one of the few ferns that possess a perceptible fragrance, and its perfume can be imitated as stated in the monograph on Fern, Volume II.

Adipic Acid, $\text{COOH} \cdot (\text{CH}_2)_4 \cdot \text{COOH}$, belongs to the saturated dibasic series and may be prepared by the action of nitric acid upon oleic acid or other fatty acids. It is a crystalline substance, soluble in alcohol, ether and hot water and melts at 153°C . Since it is non-hygroscopic it possesses advantages over both citric and tartaric acids and yet functions similarly in its cosmetic application.

Æsculin—*see* Esculin.

African Copaiba Oil is obtained by distillation from the oleo-resinous secretion of *Daniella thurifera*, a lofty tree belonging to the N.O. Leguminosæ. The oleo-resin is known also as Hardwickia Balsam and Illurin Balsam. It contains about 50 per cent of essential oil which is sometimes used as an adulterant of other oils.

Agar-Agar is a gelatinous substance prepared in Japan from different species of *Gelidium*, plants belonging to the N.O. Rhodophyceæ. A similar substance is prepared in Macassar from species of *Eucheuma* and in Ceylon from species of *Gracilaria*. The algæ are collected, washed in hot water, strained, pressed and subsequently cut into strips like straws, in which condition they appear in commerce. The principal constituent is a carbohydrate named Gelose.

¹ "Fragrant Flowers and Leaves" (1895), 3.

When agar-agar is immersed in cold water it swells, but is soluble on being boiled with water. A half per cent solution gelatinises on cooling and is useful in the manufacture of dental creams (*see* Volume II.). Agar jelly is generally used instead of gelatine jelly since its melting-point is higher. It also finds employment as a culture media for bacteria.

Ajowan Oil is distilled from the fruit of *Ptychotis ajowan*, D.C., N.O. Umbelliferae, a herb cultivated in India. Two kinds are recognised and are known respectively as "Kurnool" and "Indore," the former being more esteemed. Locally it is used as a spice and is sometimes distilled and sold as *Oman Water*. The seeds yield 3 to 4 per cent of oil which contains up to 55 per cent of **Thymol**. It is the principal commercial source of this article. The plant has recently been grown experimentally in the Seychelles and Montserrat : in the former it yielded 9 per cent of oil containing 38 per cent of thymol, and in the latter 3 per cent of oil containing 54 per cent of thymol.

Ajowan oil is occasionally used in soap perfumery in place of thyme oil, but very small percentages only are employed.

Alcohol, C_2H_5OH , also known as *rectified spirits of wine* and *ethyl alcohol* or *hydroxide*, is obtained when fermented saccharine liquids are subjected to distillation. Various methods are used in different countries for the production of this expensive (by duty) and valuable solvent, but in all cases the general principles are the same. Sugar solutions are reacted upon by yeast, and the alcohol is separated from the fermented liquid by fractional distillation. These saccharine liquids are prepared in England principally from grain starch (a very large proportion of perfumery alcohol is, in fact, obtained from molasses imported from Jamaica), in France from beet sugar, in Germany from potato starch, and in America and the East from maize and rice respectively. The quantities of the various materials used in distilling in Great Britain and Northern Ireland during the year ending September 30, 1928, were as follows :—

Materials used.	Cwt.
Malt	1,850,956
Unmalted grain	1,884,546
Rice	11,470
Molasses	1,754,793
Pea meal	288
Spirits distilled (proof gallons)	33,540,386

The alcohol from potatoes is not esteemed so highly as that from beet sugar and grain, since it contains a larger proportion of objectionable odoriferous substances, which are always formed by secondary reactions during fermentation. These bodies are usually known as **Fusel Oils**, and in the case of grain alcohol consist principally of *anethic ether* and *amyl alcohol*; in potato alcohol of *amyl*, *propyl*, *iso-propyl*, *butyl*, and *iso-butyl alcohols*, and in alcohol from molasses of *caproic*, *caprylic*, and *capric ethers*. In order to eliminate these bodies the alcohol is usually diluted with water when the insoluble oily impurities separate and are removed by filtration through charcoal. The filtrate is then fractionally distilled, the first runnings, containing aldehyde, being separated. The middle portions constitute rectified spirit, while the *tailings* contain the higher homologues of ethyl alcohol.

The rectified spirit so obtained usually contains from 90 to 95 per cent by volume of absolute alcohol and also traces of odoriferous impurities not completely separated by the first fractional distillation. The presence of these bodies is not desired by the perfumer as they would exert a deleterious influence on the fragrance of any perfume, particularly such delicate examples as eau-de-Cologne and lavender water. In order to further purify the alcohol it is fractionated a second and sometimes a third time, thus yielding a very fine product. Some years ago, however, it was treated with potassium permanganate or silver nitrate and allowed to settle. The supernatant liquid was poured off, traces of chalk added and the mixture re-distilled. The resulting product was called *Cologne spirit*, and was a colourless, transparent, and mobile liquid of slight but pleasant odour.

TABLE I.

Specific Gravity of Mixtures of Alcohol and Water.

Specific Gravity at 60° F. (15.5° C.).	Absolute Alcohol.		Per-centage of Proof Spirit.	Specific Gravity at 60° F. (15.5° C.).	Absolute Alcohol.		Per-centage of Proof Spirit.
	By Volume.	By Weight.			By Volume.	By Weight.	
1000	0.00	0.00	0.00	965	30.34	24.97	53.04
999	0.66	0.53	1.16	964	31.18	25.68	54.51
998	1.34	1.07	2.33	963	31.99	26.37	55.93
997	2.02	1.61	3.52	962	32.79	27.06	57.33
996	2.72	2.17	4.73	961	33.56	27.73	58.68
995	3.42	2.73	5.98	960	34.33	28.39	60.03
994	4.14	3.31	7.24	959	35.06	29.03	61.32
993	4.88	3.90	8.51	958	35.79	29.66	62.60
992	5.63	4.51	9.82	957	36.50	30.28	63.85
991	6.40	5.13	11.16	956	37.20	30.90	65.09
990	7.18	5.76	12.53	955	37.89	31.50	66.29
989	7.98	6.41	13.94	954	38.57	32.09	67.48
988	8.80	7.08	15.38	953	39.22	32.67	68.62
987	9.65	7.76	16.85	952	39.87	33.25	69.76
986	10.51	8.46	18.34	951	40.50	33.81	70.87
985	11.40	9.18	19.87	950	41.13	34.37	71.98
984	12.29	9.91	21.44	949	41.74	34.92	73.05
983	13.20	10.65	23.02	948	42.35	35.46	74.12
982	14.13	11.42	24.66	947	42.95	36.00	75.17
981	15.08	12.20	26.32	946	43.54	36.54	76.21
980	16.04	12.99	27.99	945	44.13	37.07	77.24
979	17.02	13.80	29.70	944	44.71	37.60	78.26
978	18.00	14.61	31.42	943	45.28	38.12	79.26
977	18.99	15.43	33.15	942	45.85	38.64	80.26
976	19.98	16.25	34.87	941	46.40	39.15	81.23
975	20.97	17.08	36.61	940	46.95	39.65	82.19
974	21.96	17.90	38.35	939	47.50	40.15	83.15
973	22.94	18.72	40.06	938	48.04	40.65	84.10
972	23.91	19.53	41.77	937	48.57	41.15	85.04
971	24.85	20.34	43.47	936	49.10	41.64	85.97
970	25.83	21.14	45.14	935	49.63	42.13	86.89
969	26.77	21.93	46.77	934	50.15	42.62	87.81
968	27.69	22.71	48.38	933	50.67	43.11	88.71
967	28.69	23.48	49.98	932	51.18	43.59	89.61
966	29.48	24.23	51.53	931	51.68	44.06	90.49

TABLE I.—*continued.*

Specific Gravity of Mixtures of Alcohol and Water.

Specific Gravity at 60° F. (15.5° C.).	Absolute Alcohol.		Percentage of Proof Spirit.	Specific Gravity at 60° F. (15.5° C.).	Absolute Alcohol.		Percentage of Proof Spirit.
	By Volume.	By Weight.			By Volume.	By Weight.	
930	52.18	44.53	91.36	897	67.08	59.37	117.54
929	52.67	45.00	92.93	896	67.50	59.80	118.26
928	53.16	45.47	93.09	895	67.92	60.23	118.98
927	53.65	45.94	93.95	894	68.33	60.66	119.70
926	54.14	46.40	94.80	893	68.74	61.09	120.42
925	54.62	46.87	95.65	892	69.14	61.52	121.14
924	55.10	47.33	96.49	891	69.55	61.95	121.85
923	55.58	47.79	97.33	890	69.95	62.38	122.56
922	56.05	48.25	98.16	889	70.35	62.81	123.27
921	56.52	48.71	98.98	888	70.75	63.24	123.97
920	56.99	49.17	99.80	887	71.15	63.67	124.06
91976	57.10	49.28	100.00	886	71.55	64.10	125.37
				885	71.95	64.53	126.07
919	57.46	49.63	100.62	884	72.34	64.96	126.77
918	57.92	50.08	101.43	883	72.74	65.39	127.46
917	58.38	50.53	102.24	882	73.13	65.81	128.14
916	58.83	50.98	103.05	881	73.52	66.24	128.82
915	59.29	51.43	103.84	880	73.91	66.66	129.50
914	59.74	51.88	104.63	879	74.30	67.09	130.18
913	60.19	52.33	105.42	878	74.68	67.51	130.86
912	60.63	52.77	106.20	877	75.06	67.93	131.53
911	61.07	53.21	106.97	876	75.44	68.35	132.19
910	61.51	53.65	107.74	875	75.82	68.77	132.86
909	61.95	54.10	108.52	874	76.19	69.19	133.53
908	62.39	54.54	109.29	873	76.57	69.62	134.19
907	62.83	54.98	110.06	872	76.94	70.04	134.84
906	63.26	55.42	110.82	871	77.32	70.46	135.50
905	63.70	55.87	111.59	870	77.69	70.88	136.16
904	64.13	56.31	112.35	869	78.06	71.30	136.81
903	64.56	56.75	113.10	868	78.43	71.72	137.46
902	64.98	57.18	113.84	867	78.80	72.14	138.10
901	65.41	57.62	114.59	866	79.17	72.55	138.74
900	65.83	58.06	115.33	865	79.53	72.97	139.38
899	66.25	58.50	116.07	864	79.89	73.39	140.02
898	66.67	58.93	116.81	863	80.25	73.81	140.65

TABLE I.—*continued.*

Specific Gravity of Mixtures of Alcohol and Water.

Specific Gravity at 60° F. (15.5° C.).	Absolute Alcohol.		Percentage of Proof Spirit.	Specific Gravity at 60° F. (15.5° C.).	Absolute Alcohol.		Percentage of Proof Spirit.
	By Volume.	By Weight.			By Volume.	By Weight.	
862	80.61	74.22	141.28	827	91.98	88.27	161.26
861	80.97	74.64	141.91	826	92.26	88.65	161.76
860	81.32	75.05	142.54	825	92.55	89.03	162.26
859	81.68	75.47	143.16	824	92.83	89.41	162.75
858	82.03	75.88	143.78	823	93.11	89.79	162.24
857	83.38	76.30	144.40	822	93.38	90.16	163.72
856	83.73	76.71	145.01	821	93.65	90.53	164.20
855	83.08	77.12	145.62	820	93.92	90.90	164.67
854	83.42	77.53	146.23	819	94.19	91.27	165.14
853	83.77	77.94	146.83	818	94.45	91.63	165.60
852	84.11	78.35	147.43	817	94.71	92.00	166.06
851	84.44	78.76	148.03	816	94.97	92.36	166.51
850	84.78	79.17	148.62	815	95.22	92.72	166.96
849	85.12	79.58	149.21	814	95.47	93.08	167.41
848	85.46	79.98	149.80	813	95.72	93.44	167.86
847	85.80	80.39	150.39	812	95.97	93.80	168.28
846	86.12	80.79	150.97	811	96.21	94.15	168.71
845	86.44	81.20	151.55	810	96.45	94.50	169.13
844	86.77	81.60	152.12	809	96.69	94.85	169.55
843	87.09	82.00	152.68	808	96.93	95.20	169.96
842	87.42	82.40	153.25	807	97.16	95.55	170.37
841	87.74	82.80	153.81	806	97.39	95.89	170.77
840	88.06	83.20	154.37	805	97.62	96.23	171.17
839	88.37	83.60	154.92	804	97.84	96.57	171.56
838	88.68	83.99	155.47	803	98.06	96.91	171.95
837	88.99	84.39	156.02	802	98.28	97.25	172.23
836	89.30	84.78	156.56	801	98.49	97.59	172.71
835	89.61	85.17	157.10	800	98.70	97.91	173.07
834	89.91	85.56	157.63	799	98.91	98.24	173.44
833	90.22	85.95	158.16	798	99.12	98.57	173.80
832	90.52	86.34	158.68	797	99.32	98.90	174.16
831	90.82	86.73	159.21	796	99.52	99.22	174.52
830	91.11	87.11	159.73	795	99.72	99.55	174.87
829	91.40	87.50	160.24	794	99.92	99.87	175.21
828	91.69	87.88	160.75	79359	100.00	100.00	175.35

TABLE II.

Dilution of Alcohol by Volume with Distilled Water.

Percentage Strength of Alcohol required by Volume.	Add to 1000 of Alcohol at							
	90.	85.	80.	75.	70.	65.	60.	55.
	Per Cent by Volume.							
85	66							
80	138	69						
75	219	145	72					
70	311	231	153	77				
65	414	330	247	164	82			
60	537	445	354	265	176	88		
55	679	579	481	383	286	190	95	
50	847	739	630	524	417	313	205	104
45	1053	933	814	695	578	461	345	229
40	1308	1173	1040	908	776	645	514	385
35	1633	1480	1329	1178	1029	880	700	583
30	2062	1886	1711	1535	1363	1189	1017	845
25	2661	2452	2243	2036	1828	1622	1417	1212
20	3558	3298	3040	2783	2526	2270	2014	1760
15	5053	4710	4369	4028	3689	3349	3011	2673
10	8045	7537	7029	6522	6016	5511	5005	4502

Examples : To convert 90 per cent to 45 per cent add to 1 litre
1053 c.c. Aqua Destil.

To convert 75 per cent to 20 per cent add to 1 litre
2783 c.c. Aqua Destil.

TABLE III.

Dilution of Alcohol by Weight with Distilled Water.

Percentage Strength of Alcohol Used.	To Produce 1000 of Alcohol at				
	50.	60.	70.	80.	90.
	Per Cent by Weight.				
96	453	555	665	783	913
95	460	564	676	796	927
94	467	573	686	808	942
93	474	582	697	820	956
92	481	590	707	832	970
91	489	599	718	845	985
90	496	609	728	858	
89	504	618	740	871	
88	511	627	752	884	
87	519	637	763	898	
86	527	646	774	912	
85	535	656	786	926	
84	543	667	798	940	
83	552	677	811	955	
82	560	687	823	969	
81	569	698	836	984	
80	578	709	849		
79	587	720	863		
78	597	732	877		
77	606	744	891		
76	616	756	905		
75	626	768	920		
74	636	781	935		
73	647	794	951		
72	658	807	967		
71	669	821	983		
70	681	835			
69	692	849			
68	705	864			
67	717	880			
66	730	896			
65	743	911			
64	756	928			
63	770	946			
62	785	963			
61	800	981			
60	815				
59	831				
58	847				
57	864				
56	881				
55	901				
54	918				
53	938				
52	958				

Examples : To make a kilo of 90 per cent by weight take
 (1) 913 grams of 96 per cent alcohol and add distilled water to make 1000 grams, or
 (2) 956 grams of 93 per cent.

Absolute Alcohol may be prepared of about 99 per cent strength by abstracting the 5 to 10 per cent of water from rectified spirit with such substances as quicklime, anhydrous copper sulphate, etc. It is at present impossible to prepare on a commercial scale absolute alcohol of 100 per cent strength, but Professor Sydney Young has shown¹ that this can be obtained by distilling together a mixture of strong alcohol, benzene, and water. Minute traces of benzene are left in the alcohol, but these may be completely removed by distillation with normal hexane.

Proof spirit is the standard upon which the Customs and Excise base all their calculations, and although few perfumers work to "proof" the following details may be found useful :—

At 51° F., proof spirit should weigh $\frac{12}{13}$ of an *equal measure* of water—

Specific gravity at this temperature	. 0·92308
" " " 60° F.	. 0·91976
Constitution of proof spirit by <i>weight</i> —	
Ethyl alcohol, sp. gr. 0·79381	. 49·28
Water	. 50·72
	<hr/>
	100·00

Constitution of proof spirit by *measure*—

Ethyl alcohol, sp. gr. 0·79381	. 57·10
Water	. 46·68

Note.—These figures, although not producing 100 by addition, produce 100 by measure of proof spirit, owing to condensation and contraction of bulk on mixing.

The origin of the term "proof" spirit may be of interest. Long before the discovery and use of our exact modern methods for the determination of the strength of alcohol it was customary for the excise officers to test their samples by pouring a given quantity on a given weight of gunpowder. If on the application of a light it ignited it

¹ In a paper read before the British Pharmaceutical Conference, 1903.

was *over* proof, if not, it was *under* proof. The application of these terms to-day is best illustrated as follows :—

- 100 per cent proof spirit at a temperature of 60° F. (15·5° C.) has a specific gravity of 0·91976 and contains 49·28 per cent absolute alcohol by weight or 57·10 per cent by measure.
- 158 per cent proof spirit (58 *over proof*) at the same temperature has specific gravity 0·883 and contains 90·22 per cent A.A. by volume or 85·95 per cent by weight.
- 42 per cent proof spirit (58 *under proof*) has specific gravity 0·972 and equals 23·91 per cent A.A. by volume or 19·53 per cent by weight.

Industrial spirit of so-called “Perfumery Quality” is now available to perfumery manufacturers, and is used by them for both fine perfumes and toilet waters.

This situation has developed in recent years owing, presumably, to a desire on the part of the authorities to give some encouragement to the English perfumery trade, and the move has certainly met with considerable success. The distillers have contributed to this end by using a double or triple rectified ethyl alcohol from molasses (if preferred from grain), and the Government chemist has also assisted by approving a finer quality of wood naphtha as denaturant, 5 per cent. of which is added to the former. The predominating odours of acetone and also of pyridine have almost disappeared from industrial alcohol, otherwise, of course, this vehicle could not be employed for perfumery.

Even so, the ideal has by no means been attained. The odour, so important to the perfumer, is not regarded by the authorities with the same gravity as taste, and to maintain this im potable quality, they insist that it must be impossible to fractionate the alcohol, so that the denaturant can be removed.

The use of diethyl phthalate would presumably be more acceptable to perfumers because it is odourless and quite undrinkable, but the difficulty is that it can be easily removed by fractional distillation, because the boiling-point is so high (295° C.) compared with that of ethyl alcohol (78° C.). However, it might be admitted by the authorities,

that since their officers have access to all works using this alcohol, it would surely be an easy matter for them to detect such fraud and deal with it accordingly.

A mutually satisfactory solution will doubtless be found when an odourless but impotent organic body is discovered having a boiling range of about 66° to 78° C.

In America, industrial alcohol is denatured with 1 per cent. of diethyl phthalate or with 0.014 per cent. of brucine sulphate, a poisonous alkaloidal salt. The majority of perfumers appear to prefer the former and find it eminently satisfactory.

The *aliphatic* and *aromatic alcohols* are of considerable interest to the perfumer, as several of them occur naturally in essential oils, from which they are separated, while a number of them are now artificially prepared. The more important members of these groups are dealt with under their particular designation.

Aldehydes of both the aromatic and aliphatic series are a most important asset in the preparation of synthetic perfumes. Many of them occur naturally and in varying proportions in essential oils, for instance, benzaldehyde represents the bulk of bitter almond oil, while nonyl aldehyde is present in rose oil to the extent of a mere fraction of 1 per cent. Each of the higher aliphatic aldehydes appears to be responsible for the peculiar and yet characteristic odour note which is always associated with a particular natural oil. In a concentrated state each possesses a fatty odour typical of the series, but in extreme dilution their different odour notes are readily perceptible. On this account they require very careful and skilful use. They are named after the number of carbon atoms contained in them.

Very few synthetic perfumes do not contain one or other of the aldehydes. Many are exceedingly powerful and are only used in traces as, for example, benzaldehyde in synthetic heliotrope, decyl aldehyde in synthetic neroli, nonyl aldehyde in rose, etc. Others such as citral and anisaldehyde have not quite such powerful notes and are used in larger proportions. Of the acyclic aldehydes the saturated

straight-chain members from C_8 to C_{13} are of most importance, although methyl-*n*-nonylacetaldehyde of the saturated branched-chain series is often met with, while citral and citronellal of the unsaturated branched-chain series are in common use. Of the hydroxyaldehydes, citronellal hydrate is now universally employed. The properties of the different aldehydes are referred to under their particular designations. The following *pseudo*-aldehydes are briefly referred to here :—

Aldehydes C_{14} – C_{20} , so called, are in commerce actually as follows :—

Aldehyde C_{14} — Gamma undecalactone, peach lactone or mixtures containing this lactone.

Aldehyde C_{16} — Ethylmethylphenylglycidate or mixtures of a strawberry odour.

Aldehyde C_{18} —Gamma nonyl lactone or mixtures containing this substance and having an odour recalling coco-nut.

Aldehyde C_{20} —A raspberry compound.

Alectoria is one of the lichens from time to time found admixed with *Evernia prunastri*. If not separated, it gives the resulting oakmoss absolute an inferior odour. *See also* Oakmoss.

Alizarin, dihydroxyanthraquinone, $C_{14}H_6O_2(OH)_2$, is a dye obtainable from madder (*Rubia tinctoria*), but now synthetically prepared from anthracene. Being a diphenol, it behaves as an acid and gives a purple-red colour in alkaline solution. It may be used for tinting lotions, etc.

Alkanet is the dried root of *Alkanna tinctoria*, Tausch., N.O. Boraginaceæ, a plant grown in the south of Europe. It was at one time employed for staining wood to which it imparts a beautiful crimson colour, and in ancient times was used to stain the skin. The name anchusa root, which is sometimes given to it, is from the Greek *anchousa*, a paint. It contains alkannin (anchusic acid) to the extent

of about 5 per cent, which colouring matter occurs in the cortex. This is soluble in oils and fats, alcohol, ether, etc., but insoluble in water. Alkannin has also been observed to occur in numerous other plants.¹ The root is used chiefly for colouring oils and pomades, but as the amount of base absorbed is excessive, it is not so economical in use as a dye. A mixture of oil scarlet and violet, in the right proportions, will give an almost identical colour for tinting lip salves, etc.

Alloxan, or mesoxalylurea, $C_4H_2N_2O_4$, is used in the preparation of "blush" creams on account of the fact that it will impart to the skin a delicate pink tint if used in a very dilute form. It is usually dissolved in a little water and incorporated into cold cream. When applied to the skin no apparent effect is produced at once, but on longer exposure the colour is developed. If too high a percentage of alloxan is employed a purple colour is produced which may be removed by treatment with very dilute nitric acid.

Allspice Oil—*see* Pimento Oil.

Allyl Iso-thiocyanate, $C_3H_5N.CS$, occurs in oil of mustard, is a colourless or yellow liquid according to age, and has a remarkably pungent odour. It is of little value in perfumery.

Allyl-Pulegone is one of a number of alkyl derivatives prepared from the pulegone of pennyroyal oil. It is said to have an odour reminiscent of a mixture of vetivert and cedarwood oils.

Allyl Salicylate, $C_{10}H_{10}O_3$, is a colourless liquid boiling at $247^\circ C.$ and having a fragrant, somewhat fruity odour. So far it has not been identified in nature, but is obtained synthetically by refluxing a mixture of allyl alcohol and salicylic acid in the presence of some mineral acid. It is useful as a modifier in perfumery.

¹ A list of these appeared in the "Pharm. Journal," 4th Series, 7, 417.

Almond Oil (Bitter) is obtained when the bruised ripe seeds of *Prunus amygdalus*, Stokes, var. *amara*, Baillon, N.O. Rosaceæ, are distilled *with water* either before or after the fixed oil has been expressed. It does not occur as such in the almond kernel, but is the result of enzyme action—the glucoside amygdalin being split up into dextrose and benzaldehyde cyanhydrin under the influence of the ferment emulsin. The HCN radicle may be eventually removed from the volatile oil by a special process, and the commercial oil, much used for flavouring, has generally been submitted to this treatment. In perfumery this oil is not often used, but is replaced by benzaldehyde, artificially prepared and free from chlorine. It is used in small quantities in such perfumes as heliotrope, and has also a wide application in the soap industry.

Almonds were known nearly 4000 years ago when they constituted one of the presents sent by Israel into Egypt.¹ They are referred to in other² places in the Scriptures, and also at a later date in numerous places in the works of Theophrastus.³ The tree was supposed to be a native of Persia, and to have extended westward and become common in Palestine by the time it was first referred to in the Bible. At an early date it spread over the European and African countries bordering on the Mediterranean, and appears to have been cultivated in England during the sixteenth century. It was introduced into Southern California in 1885, and has since been successfully cultivated.

There is very little difference botanically between the trees producing bitter and sweet almonds, and both attain a height of about 25 feet. The bitter variety is supposed to have existed first, and the sweet to have been originally a “sport” which has become stabilised by cultivation.

Almond Oil (Expressed) occurs in both bitter and sweet almonds to the extent of about 45 per cent. It is

¹ Gen. xliii. 11.

² Exod. xxv. 33, and Num. xvii. 8.

³ “Enquiry into Plants,” Books 1 to 9.

a colourless to pale yellow liquid, and is useful in the preparation of skin creams and numerous other toilet articles.

Aloe-Wood Oils, known in the East as Agar-attar, are obtained by distilling selected parts of the wood of *Aquilaria agallocha*, Roxburgh, N.O. Thymeliaceæ, a tree native of the eastern parts of Bengal, Burma, Assam and Java. The odour of the oil has been compared with ambergris and santalwood, and that produced in India is said to fetch as high a price as rose otto. The tree attains a height of up to 100 feet and has a trunk from 8 to 12 feet in circumference. Very few trees are odorous, those having white or light coloured wood being almost invariably inodorous. The highly perfumed wood which is generally found in male trees about 50 years old is either veined or darkened in patches. This is supposed to be the result of a disease and it is these parts only which are of value. They are called "Aggur" or "Agar" and contain a high percentage of resin. They are cut out and graded by immersion in water. The best pieces, being heavier, sink to the bottom while the poor stuff floats. There is a Chinese variety of aloe-wood which is said to be more aromatic—the name given to it is "Fragrance sinking under water."

Aloe-wood was valued from a remote period by the Egyptians, afterwards by the Jews and Arabs and in the Middle Ages, also in Europe. To-day it is known also as Oriental signaloës. Compare also Eagle-wood.

The aloes referred to in connection with spices in the Scriptures¹ was evidently a very aromatic plant, and is probably the aloe-wood above described. It certainly is not the drug we know to-day as aloes which is the inspissated juice of a plant belonging to the N.O. Liliaceæ.

Aloesia Citriodora—see Verbena Oil. .

Alpine Rose Oil is obtained by extraction and subsequent distillation from the young, air-dried shoots of

¹ Ps. xlv. 8; Prov. vii. 17; Cant. iv. 14; St. John xix. 34.

Rhododendron ferrugineum, L., plants growing in the Italian Alps. The oil is very fragrant, light green in colour, and the yield is about 0·17 per cent.

Alpinia Oils are obtained by distillation from the rhizomes of different species of this genus which belongs to the N.O. Zingiberaceæ. *A. officinarum*, Hance, which yields up to 1 per cent of **Galangal Oil**, is indigenous to and cultivated in Siam and Cochin China. The oil is a somewhat viscid yellowish-green liquid of characteristic odour and containing cineol, pinene, eugenol and probably cadinene. *A. galanga*, Willd., yields a small quantity of a yellow oil having a spicy odour. It contains cineol, pinene, camphor and methyl cinnamate. *A. malaccensis*, Roscoe, grows in abundance in the Dutch East Indies and yields 0·25 per cent of an aromatic oil containing methyl cinnamate. *A. nutans*, Roscoe, thrives in tropical Asia and yields a small quantity of oil. Galangal oil is used as a culinary flavour. To the perfumer, the pleasant smelling distillate of *A. malaccensis* would probably be of interest, were it more accessible.

Alum is a crystalline double sulphate of either aluminium and potassium or aluminium and ammonium. Potassium alum is the more important of these substances and has the composition $\text{Al}_2(\text{SO}_4)_3, \text{K}_2\text{SO}_4, 24\text{H}_2\text{O}$. A dilute solution is used as a skin astringent after facial massage.

Aluminium Acetate, $\text{AlC}_6\text{H}_9\text{O}_6$, is obtained when freshly prepared aluminium hydroxide is dissolved in strong acetic acid. A neutral solution is powerfully astringent and has been used for checking excessive perspiration under the arms. Aluminum chloride is, however, better and safer.

Aluminium Chloride, AlCl_3 , is obtained by passing chlorine over a strongly heated mixture of alumina and charcoal. A weak solution makes an excellent astringent

lotion. It is also widely used as a deodorant. From 10 to 15 per cent in either aqueous solution or plus some borax and glycerine makes an effective product. Consult deodorants in Vol. III. R. H. Auch has shown¹ that the most effective strength is 16 per cent calculated as AlCl_3 , or 28.9 per cent calculated as $\text{AlCl}_3 \cdot 6\text{H}_2\text{O}$.

Aluminium Naphtholsulphonate, $\text{Al}_2(\text{C}_{10}\text{H}_5 \cdot \text{OH} \cdot [\text{SO}_3]_2)_3$, is a fine almost white powder soluble in water and glycerine. It has a mild antiseptic action and well-established surgical and gynaecological applications. In quantities of 2 per cent or thereabouts, suitably compounded, it has been recently used as a deodorant and astringent. For this purpose glyceric-aqueous solutions are usually tinted with traces of acid magenta.

Alumol—see Aluminum Naphtholsulphonate.

Amarante is the cock's comb or prince's feather, and perfumes bearing the name usually contain a large proportion of synthetic muguet with rose, santal, musk, and jasmin to round off the bouquet.

Amaryllis is the botanical and common English name of an extensive flowering genus of bulbous plants of the N.O. Amaryllidaceæ, chiefly natives of South America and often grown in England. The well-known belladonna lily, *Amaryllis belladonna*, and Guernsey lily, *A. sarniensis*, are natives of South Africa or the West Indies, and have become naturalised in the Channel Islands, whence their bulbs are imported to this country about September. Perfumes having this name are almost invariably of the lily type, with traces of rose, neroli, and gamma undecalactone added. Consult Volume II.

Ambergris is one of the most valuable materials used by the perfumer, and it therefore merits detailed treatment. Mr. A. C. Stirling is to-day acknowledged as one of the leading authorities on this subject, and in collaboration with

¹ "American Perfumer," June (1931), 205.

the author, contributed the following account to a well-known paper :—¹

“Ambergris has been known and prized for many centuries. It was considered an important article of trade in Audoghost in North-West Africa before 1000 A.D., and in the tenth century Ibn Haukal classed it with black slaves and gold as one of the important products of the Maghreb.” In the first half of the sixteenth century Leo Africanus records, amongst others, the following gifts made by the Sultan of Fez to a mountain chief: ‘Fiftie men slaues and fiftie women slaues, sixteen civet-cats, one pound of civet and a pound of amber (amber-gris).’² Ambergris in those days was probably prized partly for its own curious perfume, but largely, as it still is in the East to-day, for its reputed aphrodisiac properties.

“In those days and for long afterwards the origin of ambergris was a matter of speculation, because all supplies were collected from the seashore. At one time it was thought to be the excrement of a bird or a form of congealed gum (which possibly explains its curious name). It was also at different times thought to be a form of bitumen or even a marine fungus.”⁴

“Since whaling has become an established industry, however, much more is known about ambergris. It is now certain that it is produced only in the sperm whale, possibly only in the male, and then only at a time when the beast is feeding on squid, or cuttle-fish (*Elodone moschata*), of which it seems inordinately fond. Numbers of the horny beaks or mandibles of the cuttle-fish are almost invariably found embedded in ambergris, and the generally accepted explanation of its formation is that it is a pathological growth caused by the irritation of these indigestible beaks in the whale’s stomach.

“The large number of small pieces which are collected on the shores of various countries, chiefly in Australia and

¹ “Chemist and Druggist,” March 17 (1934), 294.

² E. W. Bovill, “Caravans of the Old Sahara.”

³ *Ibid.*

⁴ E. J. Parry, “Cyclopedia of Perfumery.”



[R. C. Treutt & Co., Ltd.
FIG. 1. - Cuttle Fish Beaks found in Ambergris (actual size).
[To face page 26.



FIG. 2.—Lump of Ambergris weighing 184 pounds.
[*R. C. Truett & Co., Ltd.*
[To face page 27.]

New Zealand, and on the shores of the Indian Ocean, indicate the probability that the occurrence of this internal calculus is quite common, but that it is normally got rid of in the ordinary process of nature. Anyone who is familiar with ambergris will realise that for every piece that is collected hundreds must disintegrate, or remain undiscovered. The finding of large lumps on the seashore is very rare, although there is, of course, the classic tale of the black 'mammy' in some unnamed island who sat down on a rock and after a while found that the rock had melted a little and stuck to her cotton dress. The chemist to whom she went to get cleaned up recognised it, and together they made a fortune out of the sale of the 'rock.'

"The big lump illustrated opposite which weighed 184 lbs., and measured over six feet in girth, was, however, an exception, and was found in New Zealand a few years ago. It had obviously come from the stomach of a dead whale and had never even passed into the bowel. It was a rough, dark-coated lump containing an unusual quantity of cuttle-fish 'beaks,' and was wet and evil-smelling even after its arrival in London. Apart from such few exceptions the big 'finds' are all the product of whaling stations where the sperm whale is caught and cut up. One of the largest lumps ever found came on the London market in 1913 and weighed something over 336 lbs., and since then there have been several pieces ranging in size from 100 to 200 lbs.; the last important one was taken in Norwegian waters in 1931 and weighed about 120 lbs. Although the whaling industry is almost exclusively in the hands of Norwegians, this is the only occasion on which ambergris has been taken from these seas.

"These very large lumps are invariably found in the stomach of the whale, whereas 'parcels' of 15 to 70 lbs. made up of a number of more or less spherical pieces, are occasionally found lodged in the bowel, which they partially block. These pieces are generally smooth, having been scoured free from dirt and *débris* and are of very good quality. The photograph illustrates a recently found parcel

of this type. It consisted of about thirty lumps weighing in all 205 oz., the individual lumps varying between 5 oz. and 25 oz.

"Apart from the fact that ambergris has a specific gravity of somewhere about 0.900 (and therefore floats), and that it melts at a comparatively low temperature, very little is known about its chemistry. A crystalline substance which has been given the name of 'ambreine' has been separated from it, but generally speaking, analysis is useless. In colour and appearance it varies so widely that it is extremely difficult for any but an expert to identify it. Parcels of spermaceti, gum, wax, and unidentifiable substances are continually consigned to London in the mistaken belief, or pious hope, that they are ambergris. There is very little doubt that Hasslauer¹ is correct in stating that, owing to variations in food and the temperature of the water, the quality varies according to the part of the world in which the sperm whale is living at the time of formation of the ambergris.

"White ambergris, which has been long exposed to the sea and sun is, especially in the East, considered the finest. It is comparatively rare and found only in small pieces, the largest recorded lump weighing only 20 oz. The usual fine quality is silver-grey or pale golden in colour. The colour, however, ranges from reddish through dark grey and brown, sometimes mottled, to absolutely black. The black is the poorest and least valuable, as it is generally mixed with blood and faecal matter which gives it a strong and disagreeable odour. The odour of ambergris is very characteristic but difficult to define; it has been described as 'musty,' 'musky,' and 'earthy,' but, in the fine qualities, it is not unpleasant and is reminiscent of the sea. Although ambergris is a very valuable substance and over £10,000 has been paid in the past for one lump, the popular idea of its worth is greatly exaggerated. Small lots of the finest quality when dried and cleaned have in

¹ "La Parfumerie Moderne" (1921), 56.



R. C. Treat & Co., Ltd.
FIG. 3.—Amhergnis taken from the Bowel of the Sperm Whale.
[To face page 28.]

the past been sold to the East and to perfumers for as much as 120s. an ounce, and, even in these times of depression, still command a very high figure, but such lots form only a small fraction of the ambergris which comes on the market. Normally, dealers are offered parcels of mixed qualities in a more or less dirty and sometimes wet condition and the estimation of their value is extremely difficult. The purchase of a large lump can fairly be described as a very hazardous speculation. The most valuable part of a large block is the heart or core, and this is invariably surrounded by a stratified crust of very varying thickness. Pockets of inferior black quality are inevitable, and black and useless dust is generally found between the different layers. Big pieces are generally damp even on the outside and always damp in the middle, so allowance must be made for loss in weight up to as much as 15 per cent or even 20 per cent. All these factors have to be taken into consideration and can only be estimated, so it is perhaps not altogether surprising that buyers of such parcels are difficult to find. Only experience can make such purchases possible, and experience is an expensive thing to buy in the ambergris market."

Jean Gattefossé¹ has advanced a new theory regarding the formation of ambergris in which he points out that the odour may be due to the musk odour of the cuttle-fish on which the sperm whale feeds. He recalls that the ancient Romans, according to Pliny, used in perfumery a mollusc, the *Elodone moschata*, dried and pulverised: this mollusc and several others form the principal food of the sperm whale. The ambergris calculus is probably formed by the crystallisation of the ambergris as the faecal matter is consumed by the bacillus which gives rise to the intestinal disease. The ambreine is only the structure holding the odorous material together.

Other substances closely resembling ambergris in their physical appearance have been found from time to time floating in the ocean in localities where this valuable product

¹ "La Parfumerie Moderne," Dec. (1920), 259.

is usually collected. On being examined microscopically such bodies have revealed the presence of materials of *vegetable* origin so arranged as to indicate their inclusion at the time the substance was formed, rather than extraneous matter collected while immersed in the sea.¹

True ambergris has a specific gravity varying from 0.780 to 0.920, and it softens about 60° C. and becomes liquid at higher temperatures. It is soluble in ether and certain volatile and fixed oils, is melted by boiling water, and volatilises at higher temperatures. A hot needle should enter the mass easily without sticking, a characteristic odour should be given off, and an amber-coloured molten drop should appear on removing the point. About 80 per cent of it consists of **Ambrein**, which was first extracted (with alcohol) in 1820 by Pelletier and Caventou, together with some benzoic acid.

The best quality is light grey in colour, other grades are brown, white, or black. The odorous principle as distinct from its crystalline constituent, ambrein, is stated to already exist as such in the cuttle-fish allied to *Elodone moschata*. The whale consumes large quantities of these as food, as mentioned above, but whether the odour of ambergris is due to their retention in the intestines or to bacterial action has not yet been definitely proved.

The odour of labdanum is probably the only one in the vegetable kingdom which closely approximates to that of ambergris, but an oil distilled from *Monarda didyma*, L., by Schimmel & Co.,² is also stated to resemble it.

The method of making ambergris extract has changed during the past two centuries. Some French perfumers and confectioners originally prepared an essence by rubbing down the ambergris with sugar-candy in a mortar and digesting the same in a mixture of s.v.r. and

¹ A detailed paper by H. I. Cole, dealing with such a substance, appeared in the "Philippine Journal of Science," 20 (1922), 105, and is quoted at length by the "P. and E.O.R." (1922), 300, and the "American Perfumer" (1922), 441.

² "Report," October (1904), 97.

rose spirit, while exposed to the heat of the sun. Others added to the above some musk, cinnamon, lemon, orange, rose and lavender. According to an account given in probably the earliest English treatise on perfumery by Charles Lillie in 1822, $1\frac{1}{2}$ oz. of ambergris was mixed with 30 grains of musk and 20 grains of civet. The whole was reduced to fine powder with dry and hard loaf sugar. To this was added the juice of a quarter of green unripe lemon and the whole transferred to a large thick bottle containing 3 pints of s.v.r. After luting the stopper by tying a piece of bladder over it, the bottle was placed in the constant heat of horse dung or sand for twenty-one days. According to the Lillie's editor—Colin Mackenzie—this made as fine a spirit of ambergris as could be prepared.

To-day the extract is produced in a simpler manner. Thirty grammes are reduced to powder and added to 1 litre of alcohol. The bottles containing about 5 litres are placed in a shaking machine and agitated for several days at a temperature of 25° to 30° C., this aiding the solution of the ambreine. The bottles are then removed and placed aside with occasional shaking for as long as maturing can be afforded. Filtration is effected a few days before use. Maturing of the extract is more vital in the case of ambergris than in any of the other animal infusions. A raw and unmaturred extract is valueless in perfumery. The maintenance of the product at the above-mentioned temperature is the best means of hastening maturation. So far no mention has been made of the different types of ambergris which may be employed, but naturally this has a considerable bearing upon the fineness of the resulting bouquet. Nearly five years ago, through the courtesy of Mr. A. C. Stirling (R. C. Treatt & Co., Ltd.), the author was able to put down ten different and distinct types of ambergris, and some notes upon the recently filtered extracts may be of interest :---

Sample No. 1. Colour pure white—origin New Zealand—easily disintegrated—nearly all dissolved in alcohol with no resinous globules adhering to bottle—colour of extract pale—odour clean and fine.

No. 2. Silver-grey colour—origin New Zealand—rather difficult to rub down and somewhat gummy. Solution as above—colour of extract medium—odour fine.

No. 3. Colour golden—origin North African coast—more brittle than No. 2—solution as above—extract light—odour exceptionally fine and stronger than No. 2.

No. 4. Colour golden grey—origin Gulf of Aden—easily manipulated—high percentage soluble—colour of extract medium—odour superb and of slight animal character.

No. 5. Colour pale yellow—origin Australia—almost plastic when rubbed down in mortar—little insoluble matter—colour of extract light—odour fine and clean.

No. 6. Colour dark grey with golden striations—very gummy when manipulated—not so soluble and resinous oily drops adhering to bottle—colour of extract deep—odour fine but lacking freshness, slightly animal tone.

No. 7. Colour black with some golden streaks inside—origin Azores—manipulation extremely difficult—very soluble—no adhering globules—extract colour light—odour not so pleasant.

No. 8. Hard black—origin all parts of world—manipulation as No. 7—less soluble—adherent globules of oily matter—extract deep colour—odour having animal character.

No. 9. Dry and dark grey—origin Persian Gulf—rubbed down fairly easily—very soluble—many adherent oily globules—extract medium colour—odour slightly musty but excellent amber.

No. 10. Colour dark reddish-brown—origin Madagascar—when manipulated forms gritty powder—fairly soluble with some oily globules—extract dark in colour—odour less fine.

The use of ambergris extract is confined exclusively to the preparation of fine perfumes. To these it imparts a subtle "velvetiness" which is unobtainable with any other raw material. Of the four animal extracts it has the least animal character. While musk possesses the greatest diffusive power, ambergris has the longest duration of evaporation. If a 3 per cent solution of each extract is

placed on clean absorbent paper, the musk will last only a few days while the ambergris will last for months. Some of the lighter flower perfumes are blended with ambergris alone, their delicacy of odour being much in tune with this type of extract. Perfumes having a deeper note require musk and civet as well as ambergris. Heavy perfumes, such as chypre and amber, contain castoreum also. Another remarkable attribute of both musk and ambergris is their quality of mellowing perfumes of an aldehydic character. Without these animal infusions, the aldehydes never lose their chemical note. The percentage of ambergris extract which may be employed in a finished perfume depends largely upon its intrinsic character and to some extent also upon the tastes of its creator. It is quite impossible to lay down any hard and fast rules in this direction. Experience is the only guide. For instance, while 1 per cent of extract would suffice in a cyclamen perfume, three times this amount would be desirable in a gardenia.

The cost of ambergris extract has no great material consideration in the preceding remarks, but when a cheaper perfume is required then the substitutes have to be considered either with a view to partial reduction of the amount or perhaps even complete replacement of the genuine extract. A number of artificial ambers exist—indeed, all firms of repute are able to offer products having some resemblance to the ambergris odour. Many of these are based upon labdanum—the oleo-resinous secretion from the leaves of several species of *Cistus*, a genus of the rock rose family. These plants are widely distributed over the rocky ground of the countries bordering the Mediterranean. The resultant commercial product differs considerably in odour, due in some cases to the different methods of treatment, but in the author's opinion the finest is obtained from plants growing in the Esterel—the country lying to the west of Cannes on the French Riviera. Some firms extract the oleo-resin with petroleum ether, while others use alcohol, a few offer a distilled oil of remarkable

tenacity. These synthetic ambers are offered in solid, semi-solid and liquid forms, the labdanum being skilfully blended with substances such as civet, castoreum, tolu and Peru balsams, oakmoss resin, benzoin, patchouli, vanillin, and artificial musk. A little-used oil which on evaporation has an odour distinctly resembling ambergris is that of cypress obtained from the leaves and young twigs of *Cupressus sempervirens*. This was first pointed out by the author in a monograph published eleven years ago. Of the purely chemical bodies, the most important one having an amber odour is methyl nonyl acetic aldehyde in which also the note of orange blossom is evident on extreme dilution. It is sometimes sold as amber aldehyde.

Other artificial ambergris now placed on the market are the methyl ether of mono-nitrodibromo-butyl-*m*-cresol, decahydro- β -naphthylaldehyde, 5-6-7-8 tetrahydro-1-naphthyl-acetaldehyde, and the ethyl ester of 2-4 diisopropyl phenylglycidic acid.

Ambres are solid, semi-solid, or liquid fixing agents of great power and differ slightly according to their source of manufacture. Generally they contain musk, civet, castor, etc., together with a liberal allowance of labdanum. The following formula is typical of the composition of the solid kind, the other varieties are described with formulæ in the chapter on Fixation in Volume II.

250	Labdanum.
250	Vanillin.
200	Musk ketone.
30	Oakmoss resin.
80	Siam benzoin.
70	Tolu balsam.
15	Civet.
15	Jasmine absolute.
20	Rose otto.
10	Clary sage oil.
10	Patchouly oil—English.
50	Olibanum R.

1000

Powder the solids and rub in the liquids until the mass forms a paste. If it is desired to turn out a product resembling ambergris—add sufficient powdered xylene musk to make a stiff mass. Break into pieces and dust with this powder or with vanillin.

Ambrette Oil is obtained from the seeds of *Hibiscus Abelsonschus*, L. (musk seed), N.O. Malvaceæ, a plant grown in India and Egypt. It is concrete at normal temperatures, and has a musky, aromatic odour. A liquid oil from which the palmitic acid has been removed was introduced by Schimmel & Co. in 1902. It is six times the strength of the natural oil, and makes a clear solution with 5 to 6 volumes of 80 per cent alcohol. Ambrette oil is too expensive to be largely used, but in small quantities is employed as an exalting agent in fine perfumes. The sesquiterpene alcohol **Farnesol** has been identified as a constituent of this oil, as also Ambrettolid, $C_{16}H_{28}O_2$, a 17 linked ketone discovered in an impure form by Kerschbaum. The seeds are now much extracted by the volatile solvent process and an excellent absolute results, having a remarkably persistent odour.

Ambroisia Oil is the name given to the oil distilled from the seed of *Chenopodium ambrosioides*, N.O. Chenopodiaceæ, a plant native of South America. It is a red oil with a fine odour of geraniol, recalling at the same time boldo leaf oil, due possibly to the presence of traces of ascaridol.

Amidol or Diamidophenol Hydrochloride, $C_6H_3 \cdot OH \cdot (NH_2 \cdot HCl)_2$, was first made by Gauche in 1869 and patented as a photographic developer in 1892. It is now used as a popular hair dye and yields fairly permanent brown and black shades. Moreover, it does not stain the skin and has therefore certain advantages over other types of dyes. Consult the chapter on Hair Dyes in Volume II.

Ammoniacum is a gum-resin exuded from the flowering and fruiting stem of *Dorema ammoniacum*, Don, N.O. Umbelliferæ, a perennial plant attaining a height of about

6 feet and native of Persia. The stems of these plants contain a large quantity of latex which exudes on their being punctured by a species of beetle. The milky juice hardens on exposure to the sun, and some of it continues to adhere to the stem while the other part falls to the ground. Ammoniacum is collected about the end of July, and finds its way to the Persian Gulf whence it is shipped to Europe via Bombay.¹ Two other varieties enter commerce but they do not often reach this country. They are obtained from *Ferula marmarica*, Aschers et Taub, a plant growing in Cyrenia, and *F. communis*, var. *brevifolia*, Mariz, produced in Morocco. The drug used by the ancients for fumigation and referred to by Dioscorides and Pliny is probably the product of the former.²

Ammoniacum has an odour recalling castor which is very persistent. Small quantities of a strong alcoholic tincture may be used in preparing opoponax perfumes.

Ammonia, Liquid.—The strongest solution containing 32 per cent by weight of ammonia is prepared by heating together slaked lime and ammonium chloride in a retort and passing the gas into water. It is a colourless, pungent liquid and is strongly alkaline; sp. gr. 0·880; formula NH_4OH . Liquid ammonia is used in the preparation of some stearin creams and yields a soft product. It is also employed to develop the odour of natural musk and is indispensable in the production of smelling salts.

Ammonium Carbonate consists of a mixture, in varying proportions, of two salts of ammonia: ammonium bicarbonate, $\text{H}(\text{NH}_4)\text{CO}_3$, and ammonium carbamate, $(\text{NH}_4)\text{CO}_2(\text{NH}_2)$. It is prepared by heating together calcium carbonate and an ammonia salt. It should occur in translucent fibrous pieces, but on exposure becomes much effloresced owing to loss of NH_3 with the formation of the bicarbonate. When treated with alcohol the

¹ For a more detailed account consult the author's paper in the "American Perfumer," June (1924), 201.

² See paper by O. Staph, "Kew Bulletin" (1907), 10, 375.

ammonium carbamate is dissolved, leaving the carbonate behind. It is used in preparing smelling salts and occasionally in stearin creams.

Ammonium Chloride, NH_4Cl , is a white crystalline powder which may be prepared by the combination of hydrochloric acid and ammonia. It is readily soluble in water and also less so in alcohol. Five per cent solutions in the form of lotions are used as skin bleaches.

Amonis Jamarcensis—see Wild Pimento Oil.

Amyl Acetate, $\text{CH}_3 \cdot \text{COO} \cdot \text{C}_5\text{H}_{11}$, is a liquid with a powerful fruity odour, recalling that of pear. It enters largely into the composition of artificial pear flavourings, and is often used for flavouring boiled sugar sweets. In fine perfumery it is used to impart freshness and "lift" to the initial odour note of chypre and heavy type bouquets. It is also useful in hyacinths. Amyl acetate has been identified as a constituent of angophora, apple, banana, and cocoa oils. The commercial product consists mainly of iso-amyl acetate, it boils about 140°C . and has a specific gravity of 0.876. As a middle boiling solvent the technical quality is much used in the production of nail enamels and cellulose lacquers.

Amyl Alcohol, $\text{C}_5\text{H}_{11}\text{OH}$, is a product of fermentation and is obtained by purifying fusel oil. It consists of a mixture of amyl and iso-amyl alcohols and probably traces of other alcohols. It is a clear liquid of characteristic odour and is known also as iso-butyl carbinol. Amyl alcohol has been identified as a constituent of the oils of certain species of eucalyptus, geranium Bourbon and of other oils. Commercial amyl alcohol boils about 130°C . and has a specific gravity of 0.815. It is useful as a solvent in certain nail enamels. The technical quality is used in the lacquer industry as a solvent for gums and resins. It has a wide application in the essence industry.

Amyl Anisate, $\text{C}_6\text{H}_4 \cdot \text{OCH}_3 \cdot \text{COOC}_5\text{H}_{11}$, is a colourless liquid having a soft fragrant odour. It is a useful

modifier in fancy perfumes, and has a note suggestive of castoreum.

Amyl Benzoate, $C_6H_5 \cdot COO \cdot C_5H_{11}$, is a colourless oil having an odour recalling slightly that of ambergris. It possesses remarkable fixative properties, and is useful in compounding artificial ambers (*which see*). Amyl benzoate boils at $261^\circ C.$ and has a specific gravity of 0.995. It is a good plasticiser.

Amyl Benzyl Oxide, $C_6H_5 \cdot CH_2 \cdot O \cdot C_5H_{11}$ (amyl benzyl ether), is a substance having an odour reminiscent of gardenia. It blends well with methyl para-cresol and makes a useful soap base.

Amyl Butyrate, $CH_3 \cdot (CH_2)_2 \cdot COO \cdot C_5H_{11}$, is a liquid of fruity odour employed in the manufacture of apricot, banana, pineapple, raspberry, strawberry, and cider essences. The commercial product consists mainly of iso-amyl butyrate together with other isomers. It boils about $174^\circ C.$ and has a specific gravity of 0.866. It is prepared artificially, but occurs naturally with the propionic acid ester in cocoa oil.

Amyl Caproate, $C_6H_{11} \cdot COOC_5H_{11}$, is a colourless liquid containing a mixture of isomers and is used principally in the preparation of artificial fruit essences. It is occasionally used in perfumery to give a new note to a bouquet. B.P., $212^\circ C.$; S.G., 0.865.

Amyl Caprylate, $C_7H_{15} \cdot COOC_5H_{11}$, is a colourless liquid having an odour of orris type. S.G., 0.863.

Amyl Cinnamate, $C_6H_5 \cdot CH : CH \cdot COO \cdot C_5H_{11}$, is a substance having an odour of amber type. It makes a useful fixative. S.G., 1.001; B.P., $308^\circ C.$

***a*-Amyl Cinnamic Aldehyde**, $C_6H_5 \cdot CH : C(C_5H_{11}) \cdot CHO$, is a greenish-yellow liquid having an intense odour of jasmin type. It is useful in artificial jasmin compounds, where it supplies that basic odour note previously attainable only by the use of Jasmin Absolute. About 1 per cent is also valuable in many other flower oils. This aldehyde was first marketed as a Jasmin

Aldehyde, and is one of the several valuable products arising from castor oil via œnanthic aldehyde (and plus benzaldehyde). S.G., 0.950. Impure samples have a bi-odour of benzaldehyde.

Amyl Formate, $\text{H} \cdot \text{COOC}_5\text{H}_{11}$, is a colourless liquid used in the production of fruit essences (plum). It has a more pungent fruity odour than the other esters of this series. B.P., 124°C .; S.G., 0.880. Amyl formate is sometimes used in perfumes of the *Peau d'Espagne* type.

Amyl Furoate, $\text{C}_4\text{H}_3\text{O} \cdot \text{COOC}_5\text{H}_{11}$, is an oily liquid having an odour resembling amyl salicylate, though not quite so flowery.

Amyl Heptene Carbonate, $\text{CH}_3 \cdot (\text{CH}_2)_4 \cdot \text{C} : \text{C} \cdot \text{CO}_2 \cdot \text{C}_5\text{H}_{11}$, is a colourless liquid having a powerful "heady" odour. Like the methyl derivative it yields on dilution a delightful leafy fragrance reminiscent of violets and is sometimes sold as "*Vert de Violette*." Concerning its preparation, reference should be made to methyl heptene carbonate which is produced in a similar way. Amyl heptene carbonate should be kept in 10 per cent alcoholic solution and used with discretion. The pure substance has a specific gravity of 0.969 and it boils at 148°C . at 20 mm. pressure. Traces in violet, sweet-pea, and lilac perfumes are invaluable.

Amyl Heptylate, $\text{CH}_3 \cdot (\text{CH}_2)_5 \cdot \text{COOC}_5\text{H}_{11}$, is a colourless liquid used in the preparation of fruit essences on account of its extremely powerful odour note. Traces may be used for modifying the odours of perfume compounds.

Amyl Hexoate—*see* Amyl Caproate.

α -Amyl Hydrocinnamic Aldehyde, $\text{C}_6\text{H}_5 \cdot \text{CH}_2 \cdot \text{CH}(\text{C}_5\text{H}_{11}) \cdot \text{CHO}$, is a chemical body having similar jasmin characters to amyl cinnamic aldehyde.

Amyl Laurinate, $\text{CH}_3 \cdot (\text{CH}_2)_{10} \cdot \text{COOC}_5\text{H}_{11}$, is a colourless mobile liquid having a powerful odour recalling that of peach. It is useful for giving a new and elusive note to a more or less common-place odour.

n-Amyl Methyl Ketone—*see* Methyl Amyl Ketone.

Amyl Myristinate, $\text{CH}_3 \cdot (\text{CH}_2)_{12} \cdot \text{COOC}_5\text{H}_{11}$, is a liquid having a fragrant odour of great persistence. It is a useful fixative in fancy compounds. S.G., 0.865.

Amyl Octoate—*see* Amyl Capylate.

Amyl Oxyisoeugenol is a liquid of fragrant carnation-like odour. It combines well with Ylang, Heliotropin and Rose to make exquisite bouquets. S.G., 1.038.

Amyl Phenylacetate, $\text{C}_6\text{H}_5 \cdot \text{CH}_2 \cdot \text{COOC}_5\text{H}_{11}$, is a colourless fragrant liquid having a decided animal note of castoreum type. It boils at 268°C . and has a specific gravity of 0.982 and consists principally of the iso-amyl ester. It may be employed in conjunction with ethyl cinnamate, coumarin, musk, heliotropin, rose, jasmin, and tuberose as a powder perfume. Discretion is necessary in its employment.

Amyl Phthalate, $\text{C}_6\text{H}_4 \cdot (\text{COOC}_5\text{H}_{11})_2$, is an inodorous liquid boiling at 340°C . and having a specific gravity of 1.026. It is an excellent fixative and is also a good plasticiser in nail enamels.

Amyl Propionate, $\text{C}_2\text{H}_5 \cdot \text{COOC}_5\text{H}_{11}$, is a colourless liquid of fruity odour and is used in compounding fruit essences of the apricot-raspberry type. Like some of the other amyl esters, it may be employed in traces for imparting a new note to a perfume compound. Amyl propionate boils at 60°C . and has a specific gravity of 0.874.

Amyl Pyruvate, $\text{CH}_3 \cdot \text{CO} \cdot \text{COOC}_5\text{H}_{11}$, is a viscous oil having a balsamic odour. It is useful in fancy compositions. S.G. at 17°C . 0.978.

Amyl Salicylate, $\text{C}_6\text{H}_4 \cdot \text{OH} \cdot \text{COOC}_5\text{H}_{11}$, is probably of more importance to the perfumer than all the other amyl esters. It is a colourless or amber-yellow liquid with a characteristic aromatic odour, and may be artificially prepared by the action of hydrochloric acid on a solution of salicylic acid in amyl alcohol. Amyl salicylate boils at 279°C . and has a

specific gravity of 1.054. It finds extensive application as the basis of all orchid and clover perfumes, while in smaller quantities it is useful as a modifier and fixer of such perfumes as carnation, chypre, and foin coupé. Amyl salicylate blends well with clary sage oil, oakmoss resin, geraniol and terpineol, and is sold under such names as "orchidé," "treflé," etc. The following formula will illustrate its use as a basis for treflé :—

500	Amyl salicylate.
100	Rose artificial.
60	Bergamot oil.
10	Lavender oil—English.
10	Ionone alpha.
10	Vanillin.
40	Coumarin.
200	Cananga oil, terpenecless.
20	Oakmoss resin.
10	Clary sage oil.
40	Anisic aldehyde.
<u>1000</u>	

Amyl salicylate is much used as a stable soap perfume.

Amyl Undecylenate, $\text{CH}_3 \cdot (\text{CH}_2)_9 \cdot \text{COOC}_5\text{H}_{11}$, is a colourless liquid having a powerful odour of the rose type. It is a useful adjunct in the preparation of mimosa and rose compounds and a good modifier for bouquets. S.G., 0.873; B.P., 160° C. at 3 mm.

Amyl Valerianate, $\text{C}_4\text{H}_9 \cdot \text{COOC}_5\text{H}_{11}$, is a liquid possessing an odour of ripe apples. It is used principally in compounding fruit essences but to some extent as a modifier in perfumes of the crab apple type. S.G., 0.864; B.P., 190° C.

Amylum—see Starch.

Amyris Balsamifera is the source of West Indian sandalwood oil—see Sandalwood Oil.

Amyrol is the name given to a mixture of alcohols occurring in West Indian sandalwood oil.

Androl is an alcohol isomeric with geraniol and citronellol, and has been identified in water-fennel oil.

Andropogon Oils—see the following oils : Ginger-grass, Palmarosa, Citronella, Lemon-grass.

Anethole, $\text{CH}_3 \cdot \text{CH} : \text{CH} \cdot \text{C}_6\text{H}_4 \cdot \text{OCH}_3$, is a white crystalline body melting about 22°C ., boiling at 234°C ., and having a specific gravity of 0.985 at 25°C . It is found in the oils of aniseed, star-anise, fennel, *Magnolia kobus*, and *Osmorrhiza longistylis*. It may also possibly occur in the oil distilled from *Artemisia caudata*. On oxidation it yields aubepine (anisic aldehyde), *which see*.

Schimmel & Co. have shown¹ that when anethole and oils containing it are kept for a long period exposed to the action of light and air, the anethol becomes polymerised, losing its crystallising power and greatly increasing in density. Anethol is used as a flavour (on account of its superiority over aniseed oil) in dental preparations and liqueurs. It finds occasional use in perfumes and soaps. Anethol is iso-estragol.

Angelica Oil is distilled from the roots or seeds of *Archangelica officinalis*, L., N.O. Umbelliferae, a plant indigenous to Northern Europe and Asia. According to E. Schmidt² the plant is cultivated in the districts of Colleda, Frohndorf etc., to the extent of about 70 acres. Cultivation is biennial. The roots are raised from seed in the first year ; they are then planted out in the autumn, hoed repeatedly during the ensuing spring, and dug up in the autumn. The oil is a colourless to light brown liquid, with a pleasant aromatic odour, reminiscent of a mixture of pepper and musk, and is largely used in flavouring liqueurs and to some extent in perfumery when a special note is desired (*e.g.* Chypre and Fern types). A resinoid is extracted from the root by means of volatile solvents and is a remarkably good fixative. In dental flavours both root and seed oils are

¹ "Report," October (1904), 42.

² Schimmel's "Report" (1926), 4.

very valuable blenders. Recent research undertaken by Kerschbaum has shown that pentadecanal acid of Angelica Root Oil is converted into a musk-like lactone with 16 links in its chain, and that the peculiar, aromatic, somewhat musky odour of the oil is conditioned by the presence of this lactone and perhaps by other lactones with more than 12 links in their chains.

Aniseed Oil—the commercial article is obtained by distillation from the fruits of *Illicium verum*, Hook. f., and probably other varieties of the N.O. Magnoliaceæ, ever-green trees of pyramidal shape, attaining a height of from 25 to 45 feet, and cultivated in the north-east part of Tonquin, in French Indo-China, and in the neighbourhood of Lung Chau in the Chinese province of Kwang-Si.

According to Chevalier¹ the trees flourish in a soil of red clay mixed with slate, and until about the tenth year require to be carefully tended. They flower twice yearly. The first fruits appear from the 10th to the 15th year, but the most abundant crops are obtained between the ages of 20 and 35 years. The fruits which are intended for distilling must be gathered before they are quite ripe. The collectors use bamboo ladders and gather the fruit by hand. The principal crop is collected in August and September, and a second crop in February and March. The fruits when gathered are distilled at once in primitive but very cleverly constructed stills of Chinese origin.² The oil yield varies from 1·7 to 3·5 per cent according to whether the fruit is dry or wet. With modern apparatus Chevalier is of the opinion that it would be possible to obtain a yield of 5 per cent. The leaves on distillation yield a quantity of oil which is sometimes used as an adulterant. By this means the output from a given area of trees may be increased by 50 per cent. The oil is packed by middlemen who purchase it from the distillers, test, clarify, and store it. It is exported in leads, "Red Ship" brand being one

¹ Schimmel's "Report," April (1914), 93.

² For illustrations see "La Parfumerie Moderne" (1921), 73.

of the best known. It is generally called star aniseed oil or **Badiane** (French). An oil of more delicate odour and flavour is distilled from the fruit of *Pimpinella anisum*, L., N.O. Umbelliferae, a plant grown in Spain, Russia, and Germany, but very little of it is used. The chief constituent of both oils is anethol (*which see*), together with traces of pinene, phellandrene, dipentene, *l*-limonene, hydroquinone ethyl ether, methyl chavicol, anisic aldehyde, anisic acid, anisic ketone, *p*-cymene, cineol, safrole, and terpineol. Aniseed oil is a popular flavour for dental preparations, especially if carefully blended with peppermint.

Anisic Acid, $\text{CH}_3\text{O} \cdot \text{C}_6\text{H}_4 \cdot \text{COOH}$ (*p*-methoxy benzoic acid) is a crystalline substance melting at 184°C . and having a sweet anise odour. It is a useful fixative.

Anisic Alcohol, $\text{CH}_3\text{O} \cdot \text{C}_6\text{H}_4 \cdot \text{CH}_2\text{OH}$, is a liquid substance of characteristic odour prepared from anisic aldehyde by treatment with potassium hydroxide. It congeals at 18° to 20°C . and boils at 258°C . Anisic alcohol has been identified as a constituent of Tahiti vanilla. It has a specific gravity of 1.110. In combination with the usual constituents of lilac compounds, this alcohol is valuable, especially if blended with methyl eugenol. It is very useful also in heliotrope perfumes.

Anisic Aldehyde, $\text{CH}_3\text{O} \cdot \text{C}_6\text{H}_4 \cdot \text{CHO}$, is manufactured on a large scale either by oxidising anethole or *p*-cresol methyl ether, and by methylating *p*-oxybenzaldehyde at normal temperatures. It has been identified as a constituent of the oils of Russian anise, bitter fennel, star anise leaf, Chinese aniseed, and buchu; of the absolutes of *Acacia cavenia* and *A. farnesiana* (possibly also wallflower); and of the extract of vanilla. The odour of the blossoms of *Cratægus oxycantha*, *Erica arborea*, *Pirus communis*, *Sorbus aucuparia*, and *Viburnum tinus* would also suggest the presence of aubepine. Anisic aldehyde is a colourless or straw-coloured liquid, which on exposure readily oxidises to anisic acid. It has a specific gravity of 1.128 and boils

at 247° C. Its odour distinctly recalls hawthorn blossom, of which perfume it is the base. In combination with sodium bisulphite it is sold as "crystallised aubepine." It is also very useful in acacia, cassie, new-mown hay, heliotrope, lilac, and wallflower perfumes, in soaps, and for blending in face powder perfumes. An example of an acacia soap perfume is given :—

350	Anisic aldehyde.
50	Acetophenone.
100	Bergamot oil.
200	Geranium oil—Algerian.
50	Ionone residues.
20	Bromstyrole.
100	Terpineol.
30	Nerolin.
20	Vetivert oil.
10	Styrax.
60	Musk Xylene.
10	Hydrocinnamic aldehyde.
<u>1000</u>	

Anisic aldehyde for perfumery should be made from anethol since it has a much finer odour than that prepared from cresol.

Anisol—*see* Anisic Alcohol.

Anisole, $C_6H_5 \cdot O \cdot CH_3$, is phenyl-methyl ether. A liquid of powerful odour.

***p*-Anisyl Acetaldehyde**, $CH_3O \cdot C_6H_4 \cdot CH_2CHO$, is a powerfully odorous substance of hawthorn type. It is known also as *p*-methoxy phenylacetaldehyde and is used in lilac compounds.

Anisyl Acetate, $CH_3O \cdot C_6H_4 \cdot CH_2 \cdot OOC \cdot CH_3$, is an oil of powerful odour which suggests its use in artificial cassie compounds. It has been given the misnomer "Cassie Ketone" in some countries.

Anisyl Formate, $\text{CH}_3\text{O} \cdot \text{C}_6\text{H}_4 \cdot \text{CH}_2 \cdot \text{OOC} \cdot \text{H}$, is a liquid of crude odour reminiscent of seaweed. Small quantities are useful in lilac, heliotrope, and tuberose compounds.

Anisyl Methyl Ketone—*see* Methoxy-acetophenone.

Annatto—*see* Bixine.

Anthemidis—*see* Camomile Oil.

Anthranilic Acid is a crystalline substance melting at about 144°C . It does not appear to exist as such in any plant although some of its esters are widely distributed in nature. Known also as ortho-amido-benzoic acid, it has the formula $\text{C}_6\text{H}_4 \cdot \text{NH}_2 \cdot \text{COOH}$.

Antifebrin—*see* Acetanilide.

Antipyrine, known also as phenazone, is a colourless, odourless, crystalline (or powder) substance melting at 111° to 113°C . and having the formula $\text{C}_6\text{H}_5 \cdot (\text{CH}_3)_2 \cdot \text{C}_3\text{HON}_2$. It is very soluble in both water and alcohol, and a 30 per cent solution is sometimes sold as a liquid powder or evening lotion. When rubbed into the skin, the liquid after evaporation leaves a very pleasing peach-like surface. Phenozone is incompatible with acids, alkalies, alum, ammonia, benzoates, etc., and therefore considerable care is necessary in marketing this product. The great advantage it possesses over acetanilide (*which see*) is that of greater solubility and therefore higher concentration.

Anyme Oil is obtained by distillation from the wood of *Myoporum crassefolium*, a tree native to Australia. It is a vivid yellowish liquid exhibiting a slight fluorescence and having a persistent woody odour of the pinaceous type. It might prove a useful fixative in soap and bath salt compounds.

Apopin Oil is distilled in Formosa from a Lauraceous tree of undetermined botanical origin. It is known to the natives as "Shu-yu" and is used by them to mix with

camphor oil. Among other things it contains camphor, eugenol, safrole, and cineol.

Aqua Aurantii Floris — *see* Orange Blossom in Volume II.

Aqua Rosæ—*see* Rose in Volume II.

Aquilaria Crassna—*see* Eagle-wood.

Arabis, or Rock Cress, is a large genus belonging to the N.O. Cruciferae. *Arabis albida*, L., is a species grown in rock gardens. In the spring it bears snow-white flowers which have a delicate odour suggestive of heliotropin.

Arachis Oil—*see* Katchung Oil.

Araucaria Oil is obtained by distillation from the wood of *Callitropsis araucarioides*, Compton, a tree belonging to the N.O. Pinaceæ and found in considerable quantity in the island of New Caledonia. It attains a height of about 30 feet and is found some 800 feet above sea-level. It yields about 6 per cent of a viscous oil of pleasant rose odour, and contains eudesmol (almost 60 per cent), eudesmene, geraniol as ester, and about 1 per cent of unidentified phenols. According to experiments conducted by an English perfumery paper¹ this oil should prove valuable in soap perfumery, since under exacting tests it proved more durable than guaiac wood oil.

Areca Nuts are the seeds of *Areca catechu*, L., N.O. Palmæ, a palm cultivated in India and Java. The powdered nuts are useful for making tooth powders and pastes.

Armenian Paper—Consult the chapter on incense and fumigants in Volume II.

Arnica Flower Oil is a comparative rarity. It has been distilled by Schimmel & Co.,² and was olive-brown in colour, concrete, and had a faintly aromatic odour. A

¹ "P. and E.O.R.," 16 (1925), 41.

² "Report" (1925), 5.

sample kindly supplied by this firm to the author had a very persistent "heady" odour. The flowers of *Arnica montana* have also been extracted with petroleum ether by O. Gerhardt,¹ who obtained a yield of 0.95 per cent of an intensely yellow wax-like substance of characteristic odour.

Aromadendral, $C_9H_{12}O$, is an aldehyde having an odour reminiscent of cummin. It occurs naturally in the oils distilled from different species of eucalyptus.

Aromanthemes is a name given to natural flower perfumes of high concentration, and stated to be the pure product without the addition of any synthetic or other substance—these in actual practice are only found when an adequate price is paid for them.

Arrowroot is obtained principally from the rhizome of *Maranta arundinacea*, L., N.O. Marantaceæ, a plant cultivated in Natal, St. Vincent, and Bermuda. When finely sifted and suitably perfumed it makes an excellent and cheap theatrical face powder.

Artemisia Oils are the aromatic distillates obtained from widely distributed plants of the N.O. Compositæ, the most important (*see* Wormwood Oil) occurring in North America. Among others worthy of note are the following :—

A. annua—lemon-yellow, having an odour like basil.

A. herba alba—fragrant greenish-yellow—grown in Algeria.

A. caudata—pleasant anise-like odour.

A. vulgaris—(Japanese, called Yomugi oil), bright green with a cineol-like odour.

A. glutinosa—very fragrant odour reminiscent of a mixture of borneol, spike, and rosemary oils.

Asafetida is a gum-resin obtained by incision from the root of *Ferula fetida*, Regel, N.O. Umbelliferæ, a plant

¹ "P. and E.O.R." (1929), 317.

growing in Afghanistan and Eastern Persia. In the crude state it has a most objectionable odour, but when the impurities are removed by maceration with alcohol and filtration, the resulting liquid, which contains the resin and essential oil, is valued (in traces) as a component of certain types of oriental perfumes. Its odour is very tenacious. Vanillin has been identified as a constituent.

Asarum Canadense—*see* Canadian Snake Root Oil.

Asparagus Oil has been isolated by F. Elze¹ from the small pale rose flowerets of *Asparagus Sprengeri*, Regel, N.O. Liliaceæ, a plant known as Smilax. It had an intense, almost narcotic odour resembling the fatty aldehydes. The oil was extracted by means of volatile solvents and the solid so obtained was again extracted with alcohol.

Aspic Oil—*see* under Lavender Oil.

Atlas Cedarwood Oil is obtained from the wood of *Cedrus atlantica*, Manetti, N.O. Pinaceæ, a tree closely related to the Lebanon cedar and found growing in Northern Africa. Steam distillation extracts from 3 to 5 per cent of a viscous, yellowish balsamic liquid which has been used for many years by the natives for medicinal purposes. More recently the possibilities of the use of the oil in perfumery has been exploited and a double rectified oil is now much used in soap perfumery of which an example is given below. The terpeneless oil and the resinoid extracted by means of volatile solvents are now also commercial products, the former being used in perfumes and the latter (of dark colour) in soaps. The chemistry of the oil has recently been further elucidated by Messrs. Pfau and Plattner, who have shown the odour of the oil to be due to a mixture of isomeric ketones called Atlantone. Casinene is also present in considerable quantity. The oil has an odour of Mimosa type and blends well with a variety of bouquets, of which an example follows :—

¹ Schimmel & Co., "Report" (1918), 9.

Jasmin Soap.

300	Atlas cedarwood oil.
300	Benzyl acetate.
60	Benzyl propionate.
80	Linalyl acetate.
40	Phenyl propyl alcohol.
50	Terpineol.
50	Hydroxy citronellal.
30	Petitgrain—Paraquay.
30	Bromstyrole.
20	Nerolin.
40	Para-cresyl phenylacetate.

1000

Attar—see Rose Oil, and consult Volume II.

Aubepine—see Anisic Aldehyde.

Aurantiène is a name given to the residual terpenes left behind in the refining of orange oil, and is used as a soap perfume.

Aurantiol is a condensation product of methyl anthranilate with hydroxy-citronellal. It has a fine odour of orange blossom and is a highly viscous greenish-yellow liquid of remarkable stability and strength.

It has the formula :

$\text{CH}_3 \cdot \text{COO} \cdot \text{C}_6\text{H}_4 \cdot \text{N} : \text{CH} \cdot \text{CH}_2 \cdot \text{CH}(\text{CH}_3) \cdot (\text{CH}_2)_3 \cdot \text{C}(\text{CH}_3)_2 \cdot \text{OH}$
See Schiff Bases.

Avocado Oil is obtained by expression from the dried fruits of *Persea Gratissima*, trees belonging to the N.O. Lauraceæ ; attaining a height of about 20 feet, and native to tropical America. The fruit, commonly called the Avocado Pear, has been known for about four centuries and was used by the Mexican and South American women as a skin applicant for the protection of the epidermis against dry winds. The oil contents of the wild fruits is about 6 per cent, but cultivation in California has increased this in certain varieties to about four times the amount. Commercially Avocado fruit is known in California as "Calavos," and the major part of the production is of a variety known as "Fuerte," a hybrid of the Mexican and

Guatemala fruit. This weighs from 10 to 16 ounces, and the crop is collected from November to September. The oil is prepared from fruits which have been damaged and are unfit for marketing as fresh fruit, and the contents sometimes reaches 30 per cent. If the fresh fruit were pressed, a difficultly separable water and oil emulsion would result. It is therefore dehydrated at 130°C . in an atmosphere of either nitrogen or carbon dioxide, after being peeled and seeded and sliced in thin pieces. Avocado oil is hydraulically expressed at a pressure of three or four thousand pounds to the square inch. The crude runnings are settled in tanks and the clear oil subsequently refined. This is deep green by transmitted light and deep red by reflected light, thus having a fluorescent appearance. It can be bleached, but the cost is prohibitive and cosmetic manufacturers prefer the green tint imparted to their products. It has excellent keeping properties. Avocado oil for cosmetic purposes is not chilled since many of the valuable constituents would be precipitated; the bulk of the oil consists of glycerides of oleic acid 77 per cent and of linoleic acid 11 per cent.

According to Eaton and Ball,¹ the properties that make Avocado oil a valuable cosmetic and soap constituent are as follows :—

1. It is one of the most penetrating oils known, and compares favourably with lanolin in this respect. It is thus valuable in tissue and massage creams, muscle oils and other products where lubrication and penetration are essential.
2. Its high oil soluble vitamin content.
3. Its tendency to reduce surface tensions of liquids thus forming finer emulsions.
4. It has exhibited skin healing properties.
5. It is rich in lecithin and phytosterine.
6. Therapeutically, vegetable oil creams are more desirable than mineral oil creams and are more soothing to the skin.

The claim of a high vitamin content in Avocado oil has been examined by Messrs. Bacharach and Lester Smith²

¹ "American Perfumer," June (1934), 192.

² "Analyst," November (1938).

whose conclusions were that although this oil would be quite valueless as a medicinal or commercial source of Vitamin D, it is perhaps of some scientific interest that it contains a little Vitamin D—this presumably being attributed to solar irradiation of traces of pro-vitamin D.

Avocado oil can be adopted in any cosmetic formula in which oil is an ingredient. Substitution for equal amounts of other oils is advised by these chemists. Trial batches should be made, especially if mineral oils have been supplanted by Avocado oil, since the latter, in most cases, will produce a stiffer emulsion. Avocado oil should be added just before the emulsion is formed, or at the lowest working temperature in order to assure the preservation of vitamins.

Axungia is a synonym for lard ; it is the basis of many hair pomades.

Azalea is a botanical name for a beautiful genus of shrubs of the N.O. Ericaceæ, which are natives of North America and the East. The flowers are pretty, of various colours, and resemble those of many rhododendrons, but differ from that genus in having only half the number of stamens (five). The plants also present a much more graceful appearance. The flowers of the common yellow azalea, *A. pontica*, are fragrant, and their perfume is imitated by the following formula :—

300	Geraniol—Java.
200	Hydroxy-citronellal.
140	Jasmin compound.
120	Rose centifolia.
20	Ylang manilla.
30	Alpha ionone.
60	Cinnamic alcohol.
5	Eugenol.
5	Coumarin.
10	Vanillin.
10	Musk ambrette.
100	Benzoin R.
<u>1000</u>	

Azelia Oil is a name sometimes given to cayenne linaloe oil—*see also* Oil of Bois de Rose Femelle.

Azulene is a name given by Piesse to the intensely blue colouring matter occurring in the volatile oils of camomile, milfoil, absinthe, etc.

Backhousia Oil is distilled from the leaves of *Backhousia citriodora*, F. v. Muell, N.O. Myrtaceæ, a tree native of Queensland and growing principally on the coast between Brisbane and Gympie. The oil, which occurs to the extent of about 0·7 per cent, has an odour recalling that of lemon-grass; it is, however, 10 to 20 per cent richer in citral. It was at one time a source of this aldehyde and a raw material for the manufacture of ionone, but it became unprofitable when in competition with lemon-grass. Cheel has cultivated the plants experimentally at Ashfield, and from the green leaves Penfold¹ distilled 1 per cent of oil of excellent quality. An oil has been distilled from *B. myrtifolia* by Penfold and Morrison² who found the principal constituent to be elemicin. Backhousia oil is sometimes used in soap perfumery in place of lemon oil when a new sweet note is desired.

Badiane—see Aniseed Oil (star).

Balm of Gilead—see Mecca Balsam.

Balm Oil—see Melissa Oil.

Balsam Copaiba—see Copaiba Resin.

Balsam Peru—see Peru Balsam.

Balsam Tolu—see Tolu Balsam.

Balsamo Blanco, also known as *white Peru balsam*, and *Baume Blanc de Son Sonaté*, is obtained by pressure from the fruit-pods of *Myroxylon Pereira*, Klotzsch, N.O. Leguminosæ, but has no similarity whatever to the balsam obtained from the trunk of the tree. In appearance it resembles turbid honey, of a yellowish-white colour, and its odour recalls melilot or coumarin; on exposure this alters slightly and approaches that of cedarwood. Balsamo

¹ "Technological Museum Bulletin," No. 5, 1923.

² "P. and E.O.R." (1923), 21.

Blanco has been examined analytically with the result that cinnamic acid, cinnamic alcohol, and phenyl propyl alcohol have been identified as constituents.

Bandolines—see Hair Preparations, Volume II.

Barberry, or *Berberis vulgaris*, L., is a spring shrub of the N.O. Berberidaceæ, attaining a height of a few feet and native of Europe and North America. The red fruit appears in the autumn and gives the plant an attractive appearance. The yellow flowers which bloom earlier in the year have a peculiar odour suggestive of citronellyl acetate. The finest species of this genus is probably *B. Bealii*. The flowers appear on a spike, are yellowish-green in colour, and when open, about $\frac{1}{2}$ inch in diameter. There are nine petals. When fresh the odour of the flower is quite powerful and recalls that of lily of the valley. After standing in water 24 hours the odour changes to that of lily-rose with suggestions of anisic aldehyde and indole.

Barium Sulphate, BaSO_4 , is obtained by precipitation from a soluble barium salt and a soluble sulphate; when dried this is a soft, fine white powder. Barytes, in which form this substance occurs as a mineral, should not be employed in cosmetics as it is not so suitable as the salt prepared by precipitation. Known also as blanc fixe, it is used in the manufacture of grease paints, face powders, and compacts.

Barosma—see Buchu Oil.

Basil Oil is obtained by distillation from *Ocimum basilicum*, L., N.O. Labiateæ, a herb grown in Europe, Northern Africa, the Seychelles, and Reunion. It is a limpid yellow liquid having a fresh, penetrating fragrance due probably to the principal constituent methyl chavicol in combination with linalol. The oil distilled from the French plants is exceptionally aromatic and recalls mignonette; it is useful in this perfume and also, in traces, in violet and jonquille bouquets. Excellent oils are also obtainable from Cyprus and the Seychelles.

There are several varieties of *Basilicum* of which the following may be noted :—

- O.B. var. *album*, Benth—lettuce-leaf basil.
- „ „ *purpurescens*, Benth—violet-red basil.
- „ „ *thyrsiflorum*, Benth—common white basil.
- „ „ *crispum*, E. G. Camus—curly-leaved basil.

According to E. G. Camus¹ the latter variety is most suited for cultivation since it yields the highest percentage of oil, having an odour almost identical to the commercial product.

Other species of *Ocimum* yield quite different constituents as instanced by—

- O. minimum*, L.—contains eugenol.
- O. canum*, Sims—methyl cinnamate.
- O. gratissimum*, L.—thymol.

Bath Salts—see Volume II.

Batteuse is a machine used in the South of France for extracting the perfume from concretes by means of alcohol. A full account appears in Volume II.

Bayberry—see *Myrcia Cerifera* under Waxes.

Bay Oil is obtained from the leaves of *Myrcia acris*, D.C., N.O. Myrtacæ, a shrub or tree cultivated in the West Indies where it is known as “Bois d’Inde.” This is also attributed to *Piminta acris*, Wight et Arnott, but botanists are not agreed as to the synonymity of these two species. It appears, however, from the observations of chemists on the spot that the bay oil of commerce is obtained from the many varieties of these species which are not easily differentiated morphologically. A variety known as “lemon-cilla,” from *P. acris*, var. *Citrifolia*, is, however, distinguished by the odour of its leaves which recalls a mixture of bay and lemon oils. If these leaves get into the still with the genuine bay leaves an inferior oil is produced, and this seems to account for the quality produced in Dominica.

¹ Roure-Bertrand Fils, “Bulletin,” October (1910), 23.

According to Fishlock¹ bay leaves are collected for distillation when the shrub is about five years old and are gathered in the dry months in the early part of the year (experiment has shown,² however, that the leaves are richest in oil during the months of June and July). A ten-year-old tree yields 60 to 100 pounds of leaves annually, and a peculiarity of the distillation is that common salt or sea-water is added to the leaves in the still. The Agricultural Department of Montserrat has shown³ that whereas sea-water increases the rate of distillation, fresh-water gives a higher yield. According to Collens and Warneford,⁴ live steam gives the highest yield. The oil distils in two fractions, a light one which floats on the surface of the receiver and a heavy one which sinks to the bottom. A normal oil, therefore, is only obtained by mixing these two portions. The yield is about 2 per cent, the principal constituents being eugenol and its methyl ester. It possesses a pleasant aroma, and is an indispensable constituent of bay rum. When used in soap perfumes it imparts an extraordinary degree of freshness. In traces it is of value in the preparation of carnation oils.

Bay Pine (Oyster) Oil is distilled from the leaves of *Callitris rhomboidea*, N.O. Coniferæ, a tree cultivated in the Nilgiris since 1885. It contains about 30 per cent of esters calculated as geranyl acetate, and has been recommended as particularly suitable for perfuming soap. According to Baker and Smith⁵ *C. Tasmanica* yields about six times as much oil having double the ester content.

Bay Rum—see Volume II.

Bdellium is a name given to several gum-resins exuded by species of Burseraceæ growing in India and Africa. Their botanical source is not known with certainty owing

¹ West Indian "Bulletin," 12 (1912), 513.

² Schimmel's "Report," October (1915), 7.

³ "P. and E.O.R." (1925), 263.

⁴ "P. and E.O.R." (1927), 64.

⁵ "P. and E.O.R.," 9 (1918), 108.

to the difficulty of obtaining specimens of the trees producing them. They bear some resemblance to myrrh and are said to be imported with it from time to time. There are four different specimens of bdellium in the Museum of the Pharmaceutical Society of Great Britain, which may be described as follows :—

Indian Bdellium occurring in irregular masses of a dark reddish-brown colour, covered with characteristic “pinheads” of lustrous resin. This has an odour reminiscent of cedarwood and appears to be the product of *Balsamodendron mukul*, Hooker.

Opaque Bdellium in hard spherical lumps of the colour of yellow ochre ; odour not pleasant ; has been attributed to *B. playfairii*, Hooker.

African Bdellium in large rough lumps, any smooth fractures are slate-like in appearance ; quite red to transmitted light ; odour unpleasant.

Gafal, so called by the Arabs, consisting of miscellaneous pieces in yellow and black translucent masses, slightly aromatic ; attributed to *Boswellia papyfera* or *Commiphora africana*.

Bdellium was known 6000 years ago for we find it mentioned in Genesis ii. 12, and 2000 years later in Numbers ix. 7. There appears to be no record of what this bdellium consisted, but from the first reference it may have been a mineral ! Bdellium¹ should not be confused with bissabol or *perfumed* bdellium which has quite a different and characteristic odour—see also Myrrh, Opoponax, and Bissabol.

Beeswax is the wax separated from the honeycomb of the hive bee, *Apis mellifica*, L. (and in the East probably also other species of *Apis* and *Trigona*.) It is the substance secreted on the under side of the insect and used to build up the walls of the cells of the honeycomb. It is prepared, after the honey has been extracted, by placing the combs in

¹ For a more detailed account consult the author's paper in the “American Perfumer,” May (1924), 141.

hot water and straining off the separated wax. This forms the yellow beeswax of commerce—*Cera Flava*. White beeswax is prepared from this raw material by exposing it to the action of air and sunlight for prolonged periods and also by the bleaching action of chromic and other acids. Large quantities are thus prepared in Spain, Morocco, Jamaica, California, etc. Beeswax is subject to adulteration with hard paraffin. Genuine samples should melt between 62° and 64° C. It is used in the preparation of numerous cosmetics. Beeswax consists mainly of melissyl palmitate (myricin) together with free cerotic acid, cerolein, and possibly also melissyl stearate.

Belladonna Tincture is prepared by percolating the leaves of *Atropa Belladonna*, L., N.O. Solanaceæ, with 70 per cent alcohol. It contains atropine, and is dropped into the eye, thereby dilating the pupil and adding brilliance and lustre to the dioptic. Much used by actresses, and sold diluted with distilled water as “eye-bright lotion,” etc.

Bentonite is a colloidal clay first discovered near Fort Benton, in Wyoming, U.S.A., from which its name is derived. It is used in California as a substitute in oil refining. The principal deposit is at Otay, where it occurs in white, rose, green, and brown forms. The well-known Clay Spur Brand still comes from Wyoming but deposits have also been found in Alberta, Canada. It consists mainly of silicon dioxide, together with the oxides of aluminium, iron, lime, and magnesia. When placed in water, Bentonite is capable of absorbing up to 30 times its own weight of liquid to form a gelatinous mass, which owing to its freedom from organic matter shows no tendency to fermentation or decomposition. Free alkali increases its absorbent qualities. It is an excellent detergent and may be used as a soap filler (5 or 10 per cent). Bentonite is also a good emulsifier for oleic acid and fixed oils. It is used in the preparation of some cosmetic products such as face powders, toilet creams, and beauty clays.

Benzal Acetone—see Benzylidene Acetone.

Benzaldehyde, $C_6H_5 \cdot CHO$, is present in, and almost identical with, bitter almond oil (*which see*), but may be prepared synthetically from either benzyl or benzal chlorides. The artificial product is prone to contain combined chlorine, which is probably accountable for its comparatively crude odour. Benzaldehyde free from chlorine is easily obtainable, however, and is sold as artificial almond oil. It has a specific gravity of 1.053 and boils at $179^\circ C$. Its use in fine perfumery is confined to the violet and heliotrope type of perfume (traces only). It is, however, largely employed as a soap perfume. Benzaldehyde has also been identified in the oils of macassar seeds, cinnamon root and bark, champaca, patchouli and cassia and in the concretes prepared from cassie and orange blossom. It may also occur in elder flowers.

An example of its useful application as a cheap almond soap perfume is appended :—

500	Benzaldehyde.
100	Terpineol.
100	Phenylethyl alcohol.
200	Palmarosa.
30	Caraway.
20	Citronella—Ceylon.
50	Cedarwood.
1000	

NOTE.—If benzaldehyde *contains* chlorine it will cause discoloration in soaps.

Benzaldehyde Dimethylacetal, $C_6H_5 \cdot CH(O \cdot CH_3)_2$, is a substance having a softer odour than benzaldehyde and is useful in violet compounds. It boils at $84^\circ C$. and has a specific gravity of 1.0254. Benzaldehyde Diethylacetal has similar properties.

Benzoic Acid, $C_6H_5 \cdot COOH$, occurs in numerous essential oils and gum resins (among these may be mentioned benzoin, Peru balsam, neroli, and champaca oils), sometimes in the free state and often in the form of esters. It has a weak balsamic odour, is crystalline, melting about $120^\circ C$.¹

¹ This depends on the source—synthetic 120° to 122° , natural 120 .

boiling at 249° C., and has a specific gravity of 1.201 at 21° C. It is used as a fixative. Two varieties are in use, that prepared by subliming benzoin being superior in aroma to the synthetically prepared article (hydrolysis of the chlorination product of toluene).

Benzoin is a balsamic resinous exudation from *Styrax Benzoin*, Dryander, and other species of the N.O. Styraceae, trees native to Siam and Sumatra. Four varieties are met with in commerce—Siam, Sumatra, Penang, and Palembang.

*Siam*¹ *benzoin* occurs in tears, yellowish-brown to white, brittle, melting-point 75° C. It contains up to 40 per cent benzoic acid and esters of benzoic acid, with sometimes as much as 5 per cent of vanillin. The botanical origin of this variety has not been settled with certainty. Holmes attributes it to *Styrax tonkinensis*, Craib, Drouet² mentions *Anthostyrax tonkinensis*, Pierre, as the parent plant (the tree is called *Bode* by the Anamites and *Kohnhau* by the Laos), while Rordorf considers *S. Siamensis* a more likely source. The tree is a common one in almost every altitude of northern Indo-China. It resembles our birch, grows rapidly and reaches maturity in about 10 years. The trunk is about 1 foot in diameter and begins to branch at about 16 feet from the ground. The wood is used locally in the manufacture of matches. The method of collecting Siam benzoin does not appear to be uniform, as the following two accounts will indicate. According to information received by Rordorf,³ pieces of bark of rectangular shape are loosened and the resin runs out of the inner side of the bark, solidifying there by the heat of the sun. This forms the finest quality. The smaller fragments are formed into lumps by hand. The resin is spread out on a strong mat in a heap, and ginger roots, first hollowed and filled with the marrow of the bones of the pig, are mixed with it and the mats are tied up at the end

¹ This might be more correctly described as Tong-King or Indo-China Benzoin.

² "Les Parfums de France" (1924), 209.

³ "Year Book of Pharmacy" (1911), 222.

in a bundle. The contents are examined from time to time to see if the fat has been taken up and if not fresh fat is added. It is said that rancid pork fat will not, like fresh fat, pass through the ginger root. This process takes about a year, its object being to give a fine aroma. When the fat has disappeared from the ginger, the resin is ready for export, without risk of losing its fine odour through the hot and long journey to Bangkok. According to Kerr¹ the principal method of collecting the gum is by making "V" shaped incisions through the bark. The resin runs slowly into bamboo joints placed at the bottom of the "V" and is not collected until a few weeks after the incision is made. This is generally done during the hot season. Whether any particular tree will yield gum or not can only be ascertained by tapping, as only the larger trees, and not even all of them, yield gum. The resin is also frequently found in bore holes made by insects and occasionally at the foot of the tree trunk. According to Drouet incisions are made in the trunk during June and July at distances of 6 inches and the bark slightly removed above the cut. A milky exudation then appears and is left to dry until the following December. By making incisions in different places the tree yields resin for two or three years but are often cut down after the first year. The yield averages 7 to 9½ pounds per tree per annum. In January the benzoin is sent down to Bangkok or Saigon, on the one hand, or to Hanoi or Hai-phong on the other, where it is handled and graded by Chinese traders. There are nine different qualities—"Three-drop" being a much-esteemed grade in the European markets.

Siam benzoin which is originally white and opaque, assumes a reddish-brown translucent appearance on the surface when exposed to the air. This has been shown by Reinitzer to be the result of oxidation. Siam benzoin is the only kind used in fine perfumery, and is almost completely soluble in its own weight of warm 90 per cent alcohol. If this solution is filtered bright and the alcohol recovered

¹ "Kew Bulletin" (1912), 9, 391.

at a low temperature *in vacuo*, an article is produced which is similar to those sold under such names as benzoin resin-odor, "clairs," etc. It is an excellent fixative, and will give body to almost any type of perfume. It is also very useful for the prefixation of alcohol—*see also* Fixation, Vol. II.

Sumatra benzoin is imported in rectangular blocks which, when broken, display numerous yellowish-white "almonds."

The botanical source of this variety was determined in 1787 by Jonas Dryander. The tree grows rapidly and in a few years reaches a height of 20 feet. It flourishes in the north-eastern part of Sumatra, and since benzoin is a pathogenic product, it only exudes when the plant has been wounded. According to Tschirch who studied this species in the East Indies, the tree is devoid of odour before incision. It is not worked for the resin until the seventh year. The natives then make incisions in the trunk, and from these wounds flow a milky resinous sap which is scraped off the bark and soon hardens in the air. This process is continued year after year for about twelve years, but the quality depreciates with the age of the tree.

Sumatra benzoin which is richest in white almonds is generally collected during the first three years and is known as "Head Benzoin." The subsequent runnings are not of such a fine quality and are known as "Belly." When the tree fails to yield a further supply it is felled and scraped. This product is known as "Foot Benzoin" and is of very inferior quality.¹ These varieties are used in cheaper perfumery, toilet preparations, and largely in medicine. In skin lotions the tincture is used with or without tragacanth. *Penang and Palembang benzoin*s are the poorest quality, and occur in red-brown to brown porous masses.

Benzophenone, $C_6H_5 \cdot CO \cdot C_6H_5$, is a crystalline fixative, melting at 47° - 48° C., boiling at 307° C., and having a specific gravity of 1.098 at 50° C. It has a pleasant sweet odour, may be used in Eastern compounds, and is also a

¹ For a more detailed account of benzoin consult the author's paper in the "American Perfumer," 19 (1924), 11.

valuable soap perfume. Benzophenone may be prepared from calcium benzoate by distillation, and is also known as **Di-phenyl Ketone**.

Benzo-Pyrrol—*see* Indole.

Benzosol is Guaiacol benzoate.

Benzoyl Acetone, $C_6H_5 \cdot CO \cdot CH_2 \cdot CO \cdot CH_3$, is a white crystalline substance melting at $57^\circ C$. and having a balsamic vanilla-opoponax odour. It is useful in oriental, amber, chypre and heather compounds. A type formula illustrating its application in an opoponax compound follows :—

70	Benzoyl acetone.
50	Opoponax resin.
80	Benzoin resin.
20	Liquidambar resin.
70	Rhodinyl acetate.
40	Labdanum resin.
100	Sweet orange.
100	Santal.
300	Bergamot.
70	Musk ambrette.
100	Vanillin.
<u>1000</u>	

Benzoyl Eugenol, $C_6H_5CO \cdot (C_{10}H_{11}O_2)$, crystallises in colourless and odourless needles which melt at $70.5^\circ C$. It occurs naturally in cascarilla oil.

Benzoyl Iso-Eugenol—*see* under Benzyl Iso-Eugenol.

Benzoyl Succinyl Peroxide is a crystalline substance melting at $96^\circ C$. It has an aromatic odour, a pepper-like taste and has been used as an antiseptic.

Benzyl Acetate, $C_6H_5 \cdot CH_2 \cdot OOC \cdot CH_3$, is a colourless liquid with a refreshing, fruity jasmin odour. It occurs naturally in the oils of ylang-ylang, hyacinth, and gardenia, and according to Hesse and Müller is present in jasmin oil up to about 65 per cent. Benzyl acetate may be artificially prepared by acetylizing benzyl alcohol. It has a specific gravity of 1.061 and boils at $216^\circ C$. It is one of

64 PERFUMES, COSMETICS AND SOAPS

the most useful synthetics, and being cheap, is largely used as the basis of all jasmin perfumes, being modified with methyl anthranilate and linalol. It is also useful in a wide variety of types such as coreopsis, jonquille, and tuberose compositions.

Benzyl acetate is widely used in soap perfumery since it will blend well with almost any aromatic and remains unaltered by time. An example of a jasmin-orange blossom bouquet compound is appended :—

150	Benzyl acetate.
200	Bois de Rose oil.
20	Bromstyrole.
100	Terpineol.
300	Palmarosa oil.
10	Hydrocinnamic aldehyde.
50	Musk ambrette residues.
30	Clove oil.
100	Linalyl acetate.
40	Methyl naphthyl ketone.
<u>1000</u>	

Benzyl Acetone, $C_6H_5 \cdot CH_2 \cdot CH_2 \cdot CO \cdot CH_3$, is an oil having a strong odour of jasmin type. It is useful in soaps.

Benzyl Alcohol, $C_6H_5 \cdot CH_2OH$, is a colourless liquid with a faintly aromatic odour when freshly prepared; on exposure the odour becomes "almondy," owing to the formation of dibenzyl oxide and benzaldehyde, the latter being produced (according to Blanc) by auto-oxidation. This alcohol has been found naturally in the oils of tuberose, ylang-ylang, champaca, wallflower, jasmin, clove, hyacinth, *robinia pseudo-acacia*, and cassie flowers, but may be synthetically obtained by heating benzyl chloride for a long period with solution of potassium carbonate. S.G., 1.050. B.P., 206° C. It is a valuable fixative, and enters the composition of numerous floral oils, notably those of jasmin, tuberose, and ylang-ylang.

Benzyl Amyl Oxide—see Amyl Benzyl Oxide.

Benzyl Benzoate, $C_6H_5 \cdot CH_2 \cdot OOC \cdot C_6H_5$, when absolutely pure is a solid, melting at $20^\circ C.$, but traces of impurities are sometimes present in the commercial article, which in consequence is liquid. S.G., 1.120; B.P., $323^\circ C.$ This is a viscous oil, with a very faint odour, and has recently found application in medicine. In perfumery it is extensively employed as a solvent for artificial musk and also as a fixative for many floral ottos. It occurs naturally in the balsams of Tolu and Peru and in the oils of tuberose, ylang-ylang, and hyacinth. One kilo of benzyl benzoate will dissolve approximately 450 grams musk ambrette, 205 grams musk ketone and 280 grams musk xylene.

Benzyl Butyrate is an oil with a characteristic heavy fruity odour, and is useful for modifying jasmin perfumes. It has the formula $C_6H_5 \cdot CH_2 \cdot OOC \cdot C_3H_7$, boils at 242° , and has a specific gravity of 1.015.

Benzyl Cinnamate is a crystalline compound melting about $32^\circ C.$, and boiling at $200^\circ C.$ It occurs naturally in Peru and Tolu balsams, etc., and has a heavy, persistent aroma. It is useful in preparing perfumes of the Oriental type (especially those intended for face powders), and is also employed in compounding ambrè Colognes and lavender waters. It may be prepared artificially by refluxing a mixture of sodium cinnamate, benzyl chloride and alcohol, and has the formula $C_6H_5 \cdot CH_2 \cdot OOC \cdot CH : CH \cdot C_6H_5$.

Benzyl Cyanide, $C_6H_5 \cdot CH_2CN$, is a colourless liquid of fragrant odour, probably occurring in orange flower water. It is formed during the synthesis of phenylacetic acid. Benzyl cyanide has a specific gravity of 1.016 and boils at $231^\circ C.$ It is the product of a reaction between benzyl chloride and sodium cyanide.

Benzyl Ethyl Butyro-lactone is an oil of heavy fruity odour.

Benzyl Ethyl Carbinol, $C_6H_5 \cdot CH_2 \cdot CH(OH) \cdot C_2H_5$, is a colourless oily liquid having a mild hyacinth odour.

Benzyl Ethyl Oxide, $C_6H_5 \cdot CH_2 \cdot O \cdot C_2H_5$, is a colourless liquid having a powerful fruity fragrance. It is used in soap perfumery.

Benzyl Formate, $H \cdot COOCH_2 \cdot C_6H_5$, is an oil having an odour of jasmin, but harsher and more pronounced than the acetic acid ester. It is used in jasmin compounds, but oils containing it require long maturing. In traces it is also useful in tuberose compounds. Benzyl formate boils at 202° and has a specific gravity of 1.083.

Benzyl Heptine Carbonate, $CH_3 \cdot (CH_2)_4 \cdot C : C \cdot CO_2 \cdot CH_2 \cdot C_6H_5$, is a substance having similar properties to methyl heptine carbonate (which *see*).

Benzyl Iso-eugenol, $C_6H_5 \cdot CH_2 \cdot (C_{10}H_{11}O_2)$, occurs either as a light flocculent powder or in fine lamellæ, the former melting at 54° and the latter at 59° C. It is a very good fixative for carnation compounds up to about 10 per cent, and is used also in synthetic rose, while it possesses the unique property of giving "body" and tenacity to violet compositions. The benzoyl ether has similar properties; the odour differs slightly and the melting-point is higher— 104° to 105° C.

Benzyl Methyl Carbinol, $C_6H_5 \cdot CH_2 \cdot CH(OH) \cdot CH_3$, is a sweet-smelling oil boiling at 215° C. and is used as a modifier. It is isomeric with phenyl propyl alcohol—*see also* Dimethylbenzyl Carbinol.

Benzyl Monochlor Acetate, $C_6H_5 \cdot CH_2 \cdot OOC \cdot CH_2Cl$, is a liquid having a sharp odour of jasmin type.

Benzyl Phenylacetate, $C_6H_5 \cdot CH_2 \cdot COOCH_2 \cdot C_6H_5$, is a liquid of sweetish jasmin fragrance. It has a specific gravity of 1.103 and boils at 318° C. This substance is a useful fixative for jasmin, rose and egplantine compounds.

Benzyl Propionate, $C_6H_5 \cdot CH_2 \cdot OOC \cdot C_2H_5$, is a liquid having a softer and sweeter odour than the acetic acid ester. If mixed with the latter in the proportion of about 20 per cent it will give to jasmin ottos a freshness

and originality. Benzyl propionate has a specific gravity of 1.036 and boils at 228° C. By some it is considered to recall the odour of Rhum.

Benzyl Salicylate, $C_6H_4 \cdot OH \cdot COOCH_2 \cdot C_6H_5$, is a crystalline substance having a faint odour. It is a useful fixative and solvent for artificial musks, and finds employment in carnation, jasmin, lilac, lily and bouquet compounds. It melts at about 22° C., boils at 187° C. and has specific gravity 1.180.

Benzyl Succinate is a white or faintly yellowish-white, crystalline, odourless, almost tasteless powder, permanent in the air and melting at 45° C. It resembles the benzoate in its therapeutic action, and when dissolved in a very volatile oil will give it greater persistence. Benzyl succinate has the formula $(CH_2 \cdot COOCH_2 \cdot C_6H_5)_2$.

Benzyl Valerianate, $C_6H_5 \cdot CH_2 \cdot OOC \cdot C_4H_9$, is a liquid having a slight but characteristic fruity odour, and is used as a modifier in the preparation of artificial rose and opoponax compounds. It has a specific gravity of 0.996 and boils at 250° C.

Benzylidene Acetone, $C_6H_5 \cdot CH : CH \cdot CO \cdot CH_3$, is obtained when benzaldehyde and acetone are condensed by the aid of dilute caustic soda. It is a crystalline substance, melting at 41° C., boiling at 260° C. and has S.G. 1.037. Benzylidene acetone possesses a powerful and persistent floral odour, recalling that of sweet-pea. It has found a permanent place in perfumery, and is the predominating note in many sweet-pea compounds. From 3 to 5 per cent in combination with iso-butyl benzoate, hydroxycitronellal, terpeneol, and heliotropin, together with traces of methyl-nonylketone, give a remarkable representation of the sweet-pea aroma. It is also recommended in traces in eau-de-Cologne, jonquille, violet, fern, musk, and lavender. Benzylidene acetone has been found to have an irritating effect upon some skins and it should not therefore be used in compounds intended for perfuming skin preparations.

In soap perfumery it is useful and will blend well with bromstyrole, terpineol, clove, cassia, and cedarwood. An illustration of its employment in a sweet-pea soap compound is appended :—

100	Cananga.
100	Terpineol.
100	Bois de rose.
100	Benzyl acetate.
80	Phenylethyl alcohol.
20	Linalyl benzoate.
50	Petitgrain—Paraguay.
20	Bromstyrole.
30	Benzylidene acetone.
20	Methyl anthranilate.
100	Cinnamic alcohol.
100	Heliotropin.
10	Methyl acetophenone.
50	Musk xylene.
120	Benzoin R.
<u>1000</u>	

Bergamiol is a pseudonym for linalyl acetate.

Bergamot Mint Oil is obtained in a yield of about 0·2 per cent from the fresh plants of *Mentha citrata*, Ehrh, N.O. Labiatae, grown in Florida and cultivated at Arlington Farm, near Washington (D.C.). It is a yellowish liquid, having a pleasant odour reminiscent of lavender oil rather than of bergamot oil. It contains about 50 per cent of linalyl acetate.

Bergamot Oil is obtained from the fresh peel of the fruit of *Citrus Bergamia*, Risso et Poit, N.O. Rutaceae, trees flourishing exclusively in the southern part of the province of Reggio-Calabria.

The production area extends along the coast between Palmi in the north and Brancalene in the south, and just round the “toe” of Italy. This covers about 90 kilometres and the trees grow from the edge of the sea to the foot of the mountains, the depth varying between one hundred and one thousand metres. The trees are not productive above an altitude of 200 to 300 metres. They

are now grafted on bitter orange, but a few hundred kilos of oil are obtained from trees grafted on Limette. They attain a height of approximately 15 feet and the lower fruits can be picked from the ground. Reggio is situated towards the northern end of the area of production, but since the southern end is more protected from the north winds, collection of the fruit commences here earliest. In a normal year it is from December 1st to February 15th, but if the winter follows a very hot summer it may begin at the end of October and finish at the end of January.

The growing of the trees and production of oil is entirely in the hands of small farmers, but when outside labour is used, the hands are paid the equivalent of about 15s. a week. In the course of growth the fruits, which are almost spherical, change colour from green to yellow, and in the view of local experts the best oil is obtained from almost yellow and nearly ripe fruits.

The yield of oil is half a kilo from 100 kilos of fruits and is obtained entirely by machine. There are two types only ; three completely automatic Avena machines are used capable of dealing with 2 tons of fruits per day. These necessitate the employment of water, whereas the old-fashioned type approximates more nearly in principle to the hand pressure used in the lemon industry and is without water. There is a distinct difference in the odour of the oils. In the older type of machine, from seven large to a dozen small fruits are placed in a circular receptacle some 9 inches deep, and a rotating plate lowered to contact with them. Upper and lower plates are tinned zinc and covered with sharp projections. After 100 rotations, indicated by a small bell, the fruits are removed, the emulsion of oil and outer part of the peel passes into a receptacle below. This is filtered by various primitive methods and the oil subsequently decanted. The treated fruits are pressed and the juice sent by bullock transport to central factories (a few make their own) for conversion into calcium citrate and ultimately citric acid. The pulp is used by the farmers as cattle food and fertiliser. The Avena machine

is capable of dealing with about 100 fruits every few minutes during which time water is sprayed on the bergamots.

The mixture of oil and water is passed into a centrifugal machine and the oil ultimately filtered.

In the opinion of local experts, while the latter system of extraction offers certain economic advantages, the contact of the oil with water has a deleterious effect upon it, and the Consortium propose to discontinue the process with one exception for experimental purposes.

According to Italian law, all producers must send their oil to the Consortium where it is analysed in well-equipped laboratories, and if approved, transferred to large tanks. Experience shows that it is better not to filter the oil bright until just before it is packed, since certain extraneous substances help to preserve it. All dealers must come to the Consortium for their oil, although it is said that a few farmers do in fact risk penalties and sell outside. Packing of the oil for many well-known London dealers was observed by the author during his visit in 1938.

The following facts emerged from a discussion with Dr. La Face, Technical Director of the Consortium :—

Colour.—Pure average oil stored in well-sealed containers should be yellowish to brownish-green.

If it is bright green then the oil is either very old and contains copper or it has been tinted artificially. Light yellow oils are only obtained from fruits grown at the higher altitudes and are few.

Ester Content.—Beginning of season 30 to 35 per cent ; end sometimes up to 43 per cent.

Rotation—Normal 14 to 20. Occasionally very low and averaging 14. This indicates a higher linolol content.

Chlorine.—Its presence is impossible naturally.

Terpeneless Oil.—Production is not allowed by law so that no question of adulteration with terpenes can arise.

The best quality bergamot oil comes from an area 10 kilometres north and 30 kilometres south of Reggio.

Bergamot oil is liable to skilful adulteration, the principal substances used being terpinyl acetate, glyceryl



FIG. 4.—Bergamots arriving at a Calabrian Factory. [W.A.P.]

[To face page 70.]

acetate, ethyl citrate,¹ and ethyl laurate. The use of the oil in perfumery is so well known that very little reference to it is necessary here. It finds a prominent place in the formulæ of eau-de-Cologne and lavender water, and will blend well with almost any synthetic. The terpeneless oil is very useful and is about thrice the concentration of the natural product. The *leaves* of the bergamot tree are sometimes distilled between February and April, at the time of pruning. One hundred kilos yield about 150 grams of oil containing over 30 per cent of linalyl acetate and some methyl anthranilate. Sometimes the leaves and young saplings of the bitter orange tree are added. The product is then said to closely resemble petitgrain oil and is used to adulterate it.

Bergaptin, $C_{12}H_{18}O_4$, is a crystalline body melting at $188^{\circ}C.$, and may be isolated from the distillation residues of bergamot oil (about 5 per cent).

Beta Ionone—*see* Ionone.

Beta Naphthol, $C_{10}H_7.OH$, is a colourless to pale buff-coloured laminæ or crystalline powder, which darkens with age. M.P., 120° to $122^{\circ}C.$ Its antiseptic and germicidal properties are made use of as a deodorant, 5 per cent being dissolved in eau-de-Cologne and packed in dark bottles.

Beta Naphthol Butyl Ether, $C_{10}H_7O.C_4H_9$, is a crystalline substance melting at $32^{\circ}C.$, and is sometimes described as **Fragarol**, but is not so well known as the two following ethers. Fragarol has a weak odour recalling that of strawberries, and finds a place in the formulæ of some Cologne and orange blossom compounds owing to its milder perfume.

Beta Naphthol Disulphonate—*see* Aluminium Naphtholsulphonate.

Beta Naphthol Ethyl Ether, $C_{10}H_7O.C_2H_5$, has similar properties to those of the methyl ether, excepting

¹ Consult the paper by Schimmel & Co., "Report," October (1910), 56.

perhaps that the odour is more delicate. The melting-point is lower— 37° C. Weight for weight it is about equal to neroli oil in strength, and is known as **Nerolin II.** or **Bromelia**. It boils at 282° C. and has a specific gravity of 1.054 at 40° .

Beta Naphthol Methyl Ether, $C_{10}H_7O \cdot CH_3$, occurs as white scales melting at 72° C., slightly soluble in alcohol, and having an odour (in dilute solutions) resembling neroli oil. It is known in commerce under two names, **Nerolin** and **Yara-Yara**. B.P., 274° C. It is largely used in soap perfumery, and is employed in the compounding of cheap Colognes. It is sometimes offered for sale as Cologne powder. An example of its application in a cheap Cologne compound for soaps is appended :—

50	β -naphthol methyl ether.
300	Lemon oil.
250	Petitgrain oil—Paraguay.
250	Bergamot oil.
30	Clove oil.
30	Methyl anthranilate.
50	Musk xylene.
40	Styrax.

1000

Betel Nut—*see* Areca Nut.

Betol is naphthol salicylate.

Betula Lenta, oil of sweet birch, is distilled from the bark of *Betula lenta*, L., N.O. Betulaceæ, trees growing in Tennessee and Virginia. The kind used is obtained from the species known locally as "Black Birch." According to Schimmel & Co.¹ trees of 1 to 2 feet in diameter are felled when they are in sap and the bark is stripped off. Small branches are employed occasionally as is also some wintergreen herb, called there "mountain tea." There are generally 10 to 20 trees on an acre of land, the stills used are comparatively crude, and the principal season for production is from May to the end of September.

Sweet birch oil consists almost entirely of methyl

¹ "Report," October (1900), 65.

salicylate. It is nearly identical with the oil from *Gaultheria procumbens*, L., N.O. Ericaceæ, and is frequently sold as such. Either of these oils may be decolorised by the addition of a few crystals of citric or tartaric acids—the mixture being frequently shaken and afterwards filtered. It may be used in the preparation of synthetic cassie oil, and is also employed in compounding new-mown hay perfumes.

Beu-Rieng Oil is obtained by distillation from the leaves of an *Alpinia* species belonging to the N.O. Zingiberaceæ and found growing in Ha-Giang (Tonking). It has a pleasant odour of Chinese tea.

Beurre de Violettes is a synonym for concrete oil of orris.

Bigarade—see Neroli Oil.

Bignonia is the name of a genus of beautiful climbing plants indigenous to the humid districts of Central America and India. *B. radicans* is grown in Britain, but is not so attractive as some of the other perfumed species of this genus. The principal representatives growing in the East are *B. suaveolens* and *B. suberosa*. They have trumpet-shaped flowers of exquisite fragrance and are much prized in India.

Binders for Perfumes—see chapter on Fixatives in Volume II.

Birch Bud Oil is obtained by distillation from the resinous leaf buds of *Betula alba*, L., plants belonging to the N.O. Betulaceæ. The yield of oil is about 5 per cent and has a pleasant balsamic odour. It is a viscid yellow liquid containing a sesquiterpene alcohol called betulol, together with some paraffin which often crystallises out at normal temperatures. Birch bud oil is used in the manufacture of hair washes.

Birch (Sweet) Oil—see *Betula Lenta*.

Birch Tar Oil is obtained in Russia by the destructive distillation of the wood of *Betula alba*. The tarry fraction

which comes over is purified by redistillation and is used as a perfume for leather. Concerning its employment in modern perfumery consult *Peau d'Espagne*.

Bismuth in the form of carbonate, subchloride (oxychloride), and subnitrate is sometimes used as a skin cosmetic in face powders, wet whites, and grease paints. These salts are obtained by precipitation from solutions of bismuth nitrate and have a tendency to darken on exposure to light. This is particularly noticeable in liquid face powders containing a bismuth salt which makes an unsightly appearance when partly shaken if not packed in amber bottles.

Bissabol is a gum resinous exudation from *Commiphora erythraea*, var. *glabrescens*, Engl., N.O. Burseraceæ, plants growing in the Ogaden country. It is known also as *perfumed* bdellium, *sweet myrrh*, and **Opoponax** and in Somaliland is spoken of as Habbak Hadi—the gum of the Hadi tree. It occurs in yellowish-brown lumps having a waxy fracture, striated and interspersed with white markings. Bissabol has a pleasant and characteristic odour reminiscent somewhat of olibanum. It is collected in the same regions as herrabol or *true myrrh*, but is always packed separately in goat-skin bags. It generally finds its way to Bombay and thence to China where it is used in religious ceremonies. Quite recently quantities have reached the Continent where the raw material has been worked up into a resinoid and much advertised as “Opoponax Resin.” It is quite different from the somewhat fœtid medicinal gum-resin previously imported and obtained probably from *Balsamodendron kataf*, Kunth, N.O. Umbelliferæ.¹

Bitter Almond Oil—see Almond Oil and Benzaldehyde.

Bitter Orange Oil—see Orange Oil.

Bixine is a red colouring matter obtained from the pulp of the fruit of *Bixa Orellana*, L., N.O. Bixaceæ,

¹ For a more detailed account, consult the author's paper in the “American Perfumer,” April (1924), 75.

plants growing in Central America and the East and West Indies. It is a synonym for annatto.

Black-Current Concrete is obtained by benzene extraction of the buds of *Ribes Nigrum*, L., the common bush belonging to the N.O. Grossulariæ. It is a semi-crystalline essence having a dark-green colour and strong odour characteristic of the plant. The yield is 2·4 to 3 per cent. This product has recently been studied by Glichitch and Igolen,¹ who by steam with cohobation obtained 16 to 17 per cent of a pale-green essential oil. 85 per cent of it consisted of terpenes and sesquiterpenes including nopinene, *l*-sabinene, *d*-caryophyllene and *d*-cadinene, 6 per cent consisted of unidentified terpenic alcohols, 0·25 per cent of a mixture of phenols comprising phenol and *b*-naphthol, 0·7 per cent of combined acetic acid and 0·5 per cent of combined higher acids.

Blé des Pagodes is the name given to an oil coming from some unknown botanical species indigenous to Annam. It is said to have an odour recalling palmarosa and ginger-grass with a spice of cumic aldehyde.

Blumea—see Ngai Camphor.

Bog Myrtle, known also as candleberry myrtle, is the common name for *Myrica gale*, L., a plant belonging to the N.O. Myricaceæ and indigenous to Europe and Northern America. The plant is aromatic and bears a berry-like fruit covered with a greenish-yellow waxy secretion. This is collected by placing the berries in hot water when the wax floats on the surface. It is used in the manufacture of certain candles which when burned give off a fragrant odour.

Bois de Citron—see Bois de Rose and Linaloe Oils.

Bois d'Olhio is the name given to an oil distilled from the wood of Olhio Vehermilho (Oleo Vermelho) *Myrospermum Erythroxylon*, Fr. Allem, a tree belonging to the

¹ "Les Parfums de France" (1937), 241.

N.O. Leguminosæ. It is a native of Japan, but is apparently found also in Brazil. The beautifully marked hard red wood of this tree yields to distillation 1 per cent of a yellowish mobile oil having an odour recalling that of a mixture of santal, cedar, and rose. The oil is also extracted by means of volatile solvents, and when available in commercial quantities will make a useful fixative for soap perfumery.

Bois de Rose Femelle is the name usually given to Cayenne linaloe oil, distilled in French Guiana from the wood of species of either Burseraceæ or Lauraceæ. The botanical origin of the tree is not known with certainty. According to Moeller,¹ it is derived from *Ocotea caudata*, Mez., N.O. Lauraceæ, while Holmes² is of the opinion that it is derived from *Protium Altissimum*, March, N.O. Burseraceæ (some authorities consider the former to be Bois de Rose, *Mâle*). The young trees are known to the natives as *Licari kanali* and the older ones as a different variety which they designate *Sassafras*.

It is evident from a treatise by Bassières³ that several varieties of the tree do exist as the carpenters, etc., of the French Colony are able to differentiate those known as "bois de la Guyane, rose mâle, rose femelle, sassafras, cèdre blanc" (the names mâle and femelle have nothing to do with sex). Recent information⁴ rather indicates the source as *Acrodictidium chrysophyllum*, Messu, but there are numerous species of A. found in French Eucaria. The mâle variety is undoubtedly obtained from *Ocotea Endlicheriopsis*, Mez. The oil content of the wood may be estimated by the colour; the yellower the wood the more oil it contains. The yield is said to average about 1 per cent. This oil was first distilled by a Frenchman, M. Samain; the industry reached such dimensions that 74 tons were produced in 1923. Distilling apparatus was available

¹ "Pharm. Post," 29 (1895), 46-48, through Schimmel's "Report," October (1910), 80.

² "P. and E.O.R.," 1 (1910), 32.

³ Abstracted in Schimmel's "Report," October (1913), 72.

⁴ "Rev. Bot. Appliq." (1926), 6, 562.

on the spot, and the wood was first cut into small chips—about 100 tons were dealt with per month. The crude oil was packed in kegs and sent by river to Cayenne, where it was purified by decantation and filtration; it had a soft sweet odour reminiscent of rose, orange, and mignonette. At present there are only two distillers working and they produce only from 180 to 350 kilos per month, half going to America and the rest to Europe.

Bois de rose oil is now an important article of export from the northern states of Brazil, and owing to keen competition has practically replaced the former article although its odour is distinctly inferior. The trees are found in great profusion in a wide belt of land running from French Guiana through the northern parts of the states of Para and Amazonas. Portable distilling apparatus is used, and the chipped wood, after being softened in hot water, is distilled. The natives are paid a fixed amount per ton for the wood delivered to the still. The exports from the Amazon valley amounted to 34,646 kilos in 1927. Bois de rose oil is the source of the finest quality linalol which occurs to the extent of 60 to 90 per cent. It also contains about 5 per cent of terpineol, 2 per cent of geraniol and probably some nerol together with traces of cineol and methyl heptenol. It enters the composition of the lily and lilac type of perfume, and is used as a modifier on numerous other types such as May blossom, corylopsis, and rose perfumes. It is invaluable in numerous soaps. The terpeneless oil is about three times the concentration of the natural product—*see also* Linaloe Oil.

Bois de Siam—*see* Coffin Wood Oil.

Bokhara Clover—*see* the monograph on New-Mown Hay in Volume II.

Boldo Leaf Oil is distilled from the leaves of *Peumus Boldus*, Mol., N.O. Monimiaceæ, a fragrant tree growing in Chili. It yields about 2 per cent of a golden-yellow volatile oil having an odour which recalls that of cineol and ascaridol. It also contains cymene.

Borax, $\text{Na}_2\text{B}_4\text{O}_7 \cdot 10\text{H}_2\text{O}$, known also as sodium baborate, metaborate, or pyroborate, occurs native as the bed of dried-up lakes in California and Nevada and is purified by recrystallisation. The calcium and magnesium salts are found in heavy deposits in Chili and Peru. Borax is prepared from these salts by boiling with sodium carbonate and crystallising the liquid which is run off. It has a weak alkaline reaction and is used as a saponifying agent in the preparation of cold creams, stearin creams, etc. Crystalline borax is an important basis of bath crystals, and data concerning its use will be found in Volume II.

Boric Acid, H_3BO_3 , or boracic acid, is obtained from borax by the addition of sulphuric acid and occurs in lustrous scales. It is used in liquid shampoos for neutralising any slight excess of alkali not absorbed during saponification. A weak solution of boracic acid in rose water makes a soothing eye lotion.

Borneo Camphor—*see* Borneol.

d-Borneol or Borneo Camphor, $\text{C}_{10}\text{H}_{17}\text{OH}$, is a crystalline substance obtained from the trunk of *Dryobalanops camphora*, Colebr., N.O. Dipterocarpaceæ, a tree of majestic appearance indigenous to Sumatra and Borneo. Borneol is prepared artificially by reducing camphor with alcoholic sodium. It may be obtained commercially by separation from turpentine or from the oils distilled from other *Pinus* species. Borneol may exist also in lævo (*see* Ngai Camphor) and racemic forms, and differs from ordinary camphor in that its odour is reminiscent of patchouli and labdanum (or pepper and camphor). It has been identified as a constituent of numerous volatile oils, among which may be mentioned citronella, thyme, lavender, spike, rosemary, Canadian snake root, African ginger, and nutmeg. It is occasionally used in soap perfumery, and then generally in camphoraceous odours of the rosemary-lavender type. The natural product melts at 203°C . and the artificial about 206°C . It boils at 212°C .

Borneo camphor has been collected since the earliest times. The trees are erect and reach a height of over 100 feet. At the top they spread into a fine canopy of leaves about 50 feet in diameter over which are distributed numerous beautiful white flowers having a pleasant odour. The Borneo camphor is deposited in the form of a solid crystalline mass in the cracks and fissures of the tree and can only be removed by cutting up the whole trunk. From an account by E. Kremers¹ it appears that peculiar rites are observed by the aborigines when collecting it. Part of that produced is used locally in religious ceremonies.

Bornyl Acetate, $C_{10}H_{17}OOC \cdot CH_3$, occurs naturally in many oils, notably in that of pine needles. It may be obtained synthetically by heating borneol with anhydrous acetic acid in the presence of some sulphuric acid. M.P., $29^{\circ} C.$; S.G., 0.989; B.P., $223^{\circ} C.$ Bornyl acetate has a refreshing odour of pines, and on this account is much employed in theatre and cinema sprays. It is also used in soap perfumery where it has a powerful and persistent odour. Many lavender and fougere soap compounds owe their character to this ester. The butyric, formic, iso-valerianic, and propionic acid esters are also met with in commerce and differ only slightly in odour value. The formate is sweeter, while the butyrate is more camphoraceous than the acetic acid ester.

An example of the use of bornyl acetate in a *pine bouquet* for soaps is appended:—

200	Bornyl acetate.
150	Geranium oil—African.
170	Lemon oil.
200	Cedarwood oil.
80	Clove oil.
50	Methyl anthranilate.
70	Diphenyl methane.
30	Benzaldehyde.
50	Musk xylene.

1000

NOTE.—Natural bornyl acetate has a much finer odour than the synthetic product which is cheaper.

¹ "Pharm. Review," 23 (1905), 7, through Schimmel's "Report," April (1905), 99.

Boronia Oil is obtained by distillation from the flowers and sometimes the leaves of a species of *Boronia*, probably *B. megastigma*, a shrubby tree 3 to 4 feet high belonging to the N.O. Rutaceæ and indigenous to the Australian forests, particularly the swampy forests in the south-west of Western Australia. The flowers are comparatively insignificant, being small, highly aromatic, brown and bell-like with yellow stamens, and the leaves also are generally odoriferous. Efforts had been made up to 1922 to extract the perfume, but from correspondence which had been published,¹ it appeared that it was impossible to obtain the true perfume in the form of extract since the odour bearer broke down on contact with alcohol or water. At the British Empire Exhibition in 1924, however, specimens of a concrete otto and essential oil of boronia were shown by a well-known Australian firm. A sample of the oil examined by the author was of a dark green colour and had an odour reminiscent of lemon, orange, and rose, but this was not entirely pleasant and seemed to be tainted. To-day the flowers only are *combed* off the shrubs growing wild in the bush. They are collected principally in August, about 200 miles from Perth, W.A., and brought down in 20 lb. sealed tins. The flowers are sieved to remove leaflets and sepals and then subjected to treatment with volatile solvents. The green concrete oil has a powerful odour typical of the flower and it makes an excellent addition to bouquet perfumes of quality. A liquid absolute of high concentration is now available and dissolves completely in 90 per cent. alcohol. The odour is very fine and reminds of a citrus-rose bouquet with a subtle backing of thyme. The trees are protected by regulations of the Forestry department, and no part of the shrub, other than the flowers, can be removed. Oils have been distilled from the leaves of other species of boronia; for instance, a yield of 0.383 per cent was obtained by M. G. Smith² from *B. pinnata*. This

¹ "P. and E.O.R.," 6 (1922), 196; 9 (1922), 291.

² "Year Book of Pharmacy," 1921, 51.

had an odour of geranyl acetate. A yield of 0.5 to 0.6 per cent was obtained by A. R. Penfold¹ from *B. thujona*; this had an odour reminiscent of black currants.

More recently other species of *Boronia* have been examined. *B. citriodora* grows at high altitudes in Tasmania, where it is known as Lemon-scented Boronia. The plant is gathered in the early part of the year (before Easter) and has been distilled by Penfold, who obtained a yield of about 0.8 per cent of an oil smelling strongly of citronellol. This alcohol proved to be present to the extent of about 80 per cent together with its acetate and valerate, pinene, a sesquiterpene, a small quantity of a phenol and some free capric acid. *B. Safrolifera* bears red flowers and grows at Broadwater, N.S.W. Penfold distilled from the leaves and twigs of this plant a yellow oil containing safrrole and methyl eugenol. Other oils, distilled from the *Pinnatæ* section, are referred to at some length in a well-known English paper.²

Boronia concrete has been examined by S. Sabetay,³ whose report confirms the presence of a fair proportion of Beta Ionone, which was first discovered by A. R. Penfold.⁴

Boswellia Resin—*see* Olibanum.

Bouleau—*see* Betula Lenta Oil.

Bourbonal—*see* Ethyl Ether of Protocatechuic Aldehyde.

Bouvardia is the name given to a species of the N.O. Rubiaceæ found by Baron Humboldt in the course of his journeys in Central America and subsequently cultivated by him. The flowers emit a delicious fragrance which is generally considered to be of the jasmin type; in colour they range from whites and yellows to brilliant scarlets. Of the species grown in this country and having a pleasant fragrance are: President Garfield, Bridesmaid,

¹ "P. and E.O.R.," 11 (1923), 408.

² "P. and E.O.R." (1929), 113.

³ "Comptes Rendus" (1929), t. 189, p. 808.

⁴ "P. and E.O.R.," August (1928), 355.

Dazzler, Alfred Neuner, Humboldtii, Corymbeflora, and jasmaflora, var. odorata. Artificial bouvardia oils are therefore compounded on the basis of benzyl acetate, formate, or propionate, with the use of such modifiers as linalol, methyl-anthranilate, and hydroxy-citronellal—consult also the Jasmin monograph in Volume II.

Bromacetal, $\text{CH}_2\text{Br} \cdot \text{CH}(\text{O} \cdot \text{C}_2\text{H}_5)_2$, is produced during the synthesis of phenylacetic aldehyde (*which see*).

Bromelia—*see* β -Naphthol Ethyl Ether.

Bromo Acid—*see* Eosine.

Bromstyrole, or **Bromostyrolene**, $\text{C}_6\text{H}_5 \cdot \text{CH} : \text{CHBr}$, occurs in commerce as a colourless to dark brown liquid possessing a harsh, powerful hyacinth odour. B.P., 219°C .; S.G., 1.420. It may be prepared from styrolene, C_8H_8 , but has little use in fine perfumery, being replaced by phenylacetic aldehyde. It is, however, much used as a soap perfume, when it requires to be carefully blended to take off its crudity of odour. For this purpose substances such as methyl cinnamate, bois de rose oil, spike lavender, clove and cassia are useful. On exposure to the air *a*-bromstyrolene is oxidised to bromacetophenone.

Broom is cultivated for the extraction of its perfume in Provence where it is known as *Genêt*. The plant bears beautiful yellow flowers which emit a honey-like fragrance. The shrub, *Cytisus scoparius*, Link., belongs to the N.O. Leguminosæ and is common in Britain. Broom perfume is obtainable as concrete and liquid absolute, both of which are extracted by means of volatile solvents. Artificial broom ottos are frequently mixtures of synthetics in which methyl para-cresol is an important constituent. Such compounds may be prepared as follows :—



FIG. 5.—Cultures of Broom in Provence.

[*Antoine Chirris.*

[*To face page 82.*

10	<i>p</i> -Cresol methyl ether.
20	Methyl acetophenone.
100	Linalol.
150	Phenylethyl alcohol.
150	Terpineol.
90	Benzyl acetate.
50	Anisic alcohol.
150	Alpha ionone.
30	Phenylacetic aldehyde.
100	Heliotropin.
50	Methyl naphthyl ketone.
30	Genet absolute.
20	Phenylacetic acid.
50	Phenylethyl phenylacetate.
<u>1000</u>	

Bruyère D'Annam is the name given to the oil distilled from *Cathetus fasciculata*, Lour, a shrub of the N.O. Euphorbiaceæ, attaining a height of about 3 feet, and found growing among the hills of Southern China and Cochin China. It possesses an odour reminiscent of cajuput and has been examined by Roure-Bertrand Fils¹ who found it to contain 31 per cent of cineol. According to Murat, who distilled the oils examined by R.B.F., the plant is in full flower in the month of August. Distillation commences towards the end of January, and gives different results according to the localities in which the cutting is made, whether the plants be fresh or dry. The essential oil obtained is then sometimes of a green colour, sometimes of a pale yellow colour. This divergence would appear to be attributable to the nature of the soil. The oil may prove of some value in soap perfumery.

Buchu Oil is distilled from the leaves of several species of *Barosma*, shrubs of the N.O. Rutaceæ, indigenous to Cape Colony, the yield being about 2 per cent and the principal constituent diosphenol. The oil possesses a very pleasant aroma, but does not appear to be much used in perfumery. Two per cent of oil has been obtained from *B. venusta*. This had a pleasant odour and contained

¹ "Bulletin," April. (1914), 5.

myrcene, estragol, linalol, aldehydes, sesquiterpenes, and a small quantity of esters and phenols.

Bulnesia Sarmienti—see Guaiac Wood Oil.

Bupleurol, $C_{10}H_{20}O$, is an alcohol with a faint, rose-like odour obtained from the essential oil of *Bupleurum fruticosum*, L., N.O. Umbelliferæ, plants growing wild abundantly in the Island of Sardinia.

Burning (Irritating) Properties of aromatic substances, taking the standard as turpentine (10), are approximately as follows :—

Aldehydes . . .	33
Phenols . . .	26
Ketones . . .	12
Terpenes . . .	10
Phenolic ethers . .	8
Alcohols . . .	5
Esters . . .	4

Perfumery compounds intended for use in cosmetics should have an approximate figure of 6 and should not exceed 10. Compare fuller details under **Sting**.

Butyl Acetate, $CH_3 \cdot COOC_4H_9$, is a liquid having a nauseating odour, and is used as a solvent in the lacquer industry. It has S.G., 0.880; B.P., 126° C.

Butyl Alcohol, C_4H_9OH , is a liquid having similar properties and uses to the acetate. It has S.G., 0.815; B.P., 116° C.

Butyl Benzoate, $C_6H_5 \cdot COOC_4H_9$, is an oily liquid which functions mainly as a fixative. It has S.G., 1.0085; B.P., 247° C.

Butyl Butyrate, $C_3H_7 \cdot COOC_4H_9$, is a liquid having a fine odour of pineapples in which flavours it is much used. It has S.G., 0.871; B.P., 163° C.

***α*-Butyl Cinnamic Aldehyde**, $C_6H_5 \cdot CH : C(C_4H_9) \cdot CHO$, is obtained by condensation of normal hexyl aldehyde with benzaldehyde. It is a yellow liquid having S.G., 0.823, and B.P., 127° C. at 750 mm. The odour is

of the greenish jasmin type, and appears to be well suited for use in lilac compounds.

Butyl Formate, $\text{H} \cdot \text{COOC}_4\text{H}_9$, is a liquid of ethereal odour used in bouquet perfumes of the peau d'espagne type. It has S.G., 0.9108; B.P., 106°C .

Butyl Furoate, $\text{C}_4\text{H}_3\text{O} \cdot \text{COOC}_4\text{H}_9$, is an oily liquid, having an odour reminiscent of the salicylic acid ester of butyl alcohol.

Butyl Lactate, $\text{CH}_3 \cdot \text{CHOH} \cdot \text{COOC}_4\text{H}_9$, is a fluid substance used mainly as a plasticiser and solvent in the lacquer industry. It has S.G., 0.987; B.P., 188°C .

Butyl Phenylacetate, $\text{C}_6\text{H}_5 \cdot \text{CH}_2 \cdot \text{COOC}_4\text{H}_9$, is a colourless liquid, having a musk-rose odour. Its application is similar to that of *iso*-butyl phenylacetate (*which see*). S.G., 0.997; B.P., 260°C .

Butyl Phthalate, $\text{C}_6\text{H}_4 \cdot (\text{COOC}_4\text{H}_9)_2$, is an oily liquid used mainly as a plasticiser. It has S.G., 1.050; B.P., 325°C .

Butyl Propionate, $\text{C}_2\text{H}_5 \cdot \text{COOC}_4\text{H}_9$, is a liquid of sweetish odour recalling that of mushrooms, and has S.G., 0.883; B.P., 145°C .

Butyl Salicylate, $\text{C}_6\text{H}_4 \cdot \text{OH} \cdot \text{COOC}_4\text{H}_9$, is a liquid of powerful and persistent odour of the trèfle type, but reminiscent also of methyl salicylate. It is used as a base for fancy perfumes, and blends well with *iso*-eugenol and rhodinyl phenylacetate. It has S.G., 1.076; B.P., 267°C .

Butyl Stearate, $\text{C}_{17}\text{H}_{35} \cdot \text{COO} \cdot \text{C}_4\text{H}_9$, is a solid substance melting at 20°C . and having a specific gravity of 0.890. It is sometimes used as a plasticiser in nail enamels in conjunction with dibutyl phthalate and is reputed to enhance the lustre. Butyl stearate also finds application as a solvent for fluorescence dyestuffs in lipstick manufacture.

Butyl Tartrate, $(\text{CHOH} \cdot \text{COOC}_4\text{H}_9)_2$, is an excellent plasticiser. It has S.G., 1.064; B.P., 300°C .

Butyl Undecylenate, $C_{10}H_{21}.COOC_4H_9$, is an oil having an odour of cognac, in which compounds it is used.

Butyl Valerianate, $C_4H_9.COOC_4H_9$, is a liquid of fruity odour, having S.G., 0.8648, and B.P., $173^{\circ}C$.

Butyric Aldehyde, $C_3H_7.CHO$, is a liquid boiling at $75^{\circ}C$. and having a sharp, penetrating odour. Traces are used in modern perfumes.

Butyric Ether—*see* Ethyl Butyrate.

Buxine is a specially purified amyl cinnamic aldehyde.

Cacao Butter is a concrete oil melting about $32^{\circ}C$., and is obtained by pressing the warm crushed seeds of *Theobroma Cacao*, L., N.O. Sterculiaceæ. It is used in vanishing creams, and in moulded sticks, suitably perfumed, is sold as a grease paint remover. Medicinally it is used as the base of certain suppositories and pessaries. In the manufacture of lipsticks, about half per cent of this oil will aid smooth and easy application to the lips.

Cactus is the name originally given to spiny plants by Theophrastus. In modern botany it represents the family Cactaceæ, which comprises some 800 odd species. Most of them are indigenous to tropical America, where some attain a height of 40 or 50 feet. One of the finest collections of Cactaceæ in Europe is to be found in the rocky gardens just outside Monte Carlo. Nearly all the plants are spiny, succulent, and leafless. The fruit is frequently of a vivid red colour and is said to possess in many cases a pleasant, somewhat acid flavour. The flowers appear near the top of the plant and in a few species are fragrant. The odour is reminiscent of vanilla, rose, and jasmin. One of the most beautiful specimens is the night-blooming cereus.

Cade Oil—*see* Cadinene.

Cadinene, $C_{15}H_{24}$, is found in oil of cade, which is obtained by the destructive distillation of the wood of

different species of conifers, etc. It has been identified in the essential oils of cedarwood, santal, sassafras, wormwood, patchouli, etc., but is not extensively used in perfumery. It has been recommended as a useful constituent in synthetic ylang-ylang oil up to 5 per cent. S.G., 0.921; B.P., 274° C.

Cadmium Sulphide, CdS, is a bright yellow pigment sometimes used for tinting cosmetics. Phosphorescent (luminous) types are made under the patent 328,111 of J. Risler, who advocates their use in certain types of skin creams. A detailed account of the patent specification will be found on reference to a much-esteemed perfumery paper.¹

Calamine (genuine) is an impure zinc carbonate of pinkish tint now rarely met with in commerce. The substitutes generally marketed to-day are variable mixtures of zinc carbonate, barium sulphate, iron oxide, etc., artificially coloured and of different density. T. S. Barrie² has examined several samples, and in addition to the above ingredients has found silica, manganese dioxide, sodium sulphate, sodium carbonate, and calcium sulphate. In the course of a paper read before the British Pharmaceutical Conference in 1907, Professor R. B. Wild stated that he had experienced some difficulty in obtaining a calamine of good skin colour. After many experiments he produced a suitable shade by adding 2½ per cent of Armenian bole to precipitated zinc carbonate. Another process devised by W. Lyon consists of precipitating a solution of zinc sulphate containing a definite proportion of ferric sulphate by means of sodium carbonate.

One of the principal points to remember in the manufacture of artificial carmine is the use of an insoluble pigment, since when it is used in a lotion nothing looks worse than a pink solution and a white precipitate which results from the employment of a dyestuff for colouring.

¹ "P. and E.O.R.," January (1931), 12.

² "Pharm. Journal" (4), 11, 2

Calamine is prescribed extensively as a skin application and is also much used in the preparation of sunburn lotions. **Osmo Calamine** has been recently introduced, and in use it offers certain advantages over the heavier and coarser product—*see also* Osmo Kaolin.

Calamintha Oil—*see* Marjoram Oil.

Calamus Oil is obtained by distillation from the rhizome of the sweet flag, *Acorus calamus*, L., N.O. Aroideæ, a plant growing largely in Europe, and found on the banks of rivers. It was known from the earliest times, being mentioned in the Bible,¹ and by Theophrastus, Dioscorides, and Pliny. It is figured and described by Pomet in his "Histoire des Drogues," and according to D. Hooper² is sold in nearly every bazaar in India, where the natives esteem it very highly.

There appears to have been some confusion among the older writers as to the botanical origin of sweet calamus, for it is occasionally referred to *Andropogon calamus aromaticus*, now known as ginger-grass.

Sweet flag has been cultivated in America where the oil has been examined by G. A. Russell.³

The following bodies have, so far, been identified as constituents by different chemists: pinene, camphene, camphor, calamene, a tertiary alcohol, eugenol, and asarone. The oil has a soft, mellow fragrance reminiscent of patchouli, and is useful in chypre compositions.

Calantas Wood is used in Manilla for the manufacture of cigar boxes. It is the product of *Toona Calantas*, Mess., a tree belonging to the N.O. Meliaceæ. The wood is highly odorous, and an essential oil has been distilled from the sawdust by W. L. Brooke⁴ who in two experiments obtained yields of 1.16 and 0.32 per cent respectively.

¹ Exod. xxx. 23; Cant. iv. 14; Ezek. xxvii. 19.

² "Pharm. Journ." (4), 19, 206.

³ "J. Amer. Chem. Soc.," 1915 (37), 2387.

⁴ "Philippine Journal of Science," January, 1925.

He was able to show that the principal constituent of the oil is cadinene. It should be noted that cheaper cigars are packed in boxes made from Tangile, the wood of *Shorea polysperma*, Mess., which is odourless.

Calavos Oil—see Avocado Oil.

Calcium Phosphate (Tricalcium orthophosphate), $\text{Ca}_3(\text{PO}_4)_2$, occurs native as the mineral *osteolite*. It is prepared in the pure state by adding ordinary sodium phosphate to a solution of calcium chloride in the presence of ammonia. Calcium phosphate is used with chalk as the base of some dental creams.

Californian Laurel Oil is obtained by distillation from the leaves of *Umbellularia Californica*, Nutt, N.O. Lauraceæ, an evergreen tree indigenous to California and Oregon where it is known under various names such as "Spice," "C. Olive," "C. Bay Tree," "Pepper Tree," "Mountain Laurel," etc. It is a pale yellow liquid having a pleasantly aromatic odour which is extremely irritating when strongly inhaled. It has been examined by Power and Lees who have identified umbellulone, cineol, methyl eugenol, *l*-pinene, eugenol, and safrole as constituents.

Californian Poppy is the name often given to *Romneya coulteri*, a herbaceous perennial of the N.O. Papaveraceæ. From June to September it bears large white flowers like single peonies, having a delicate magnolia-like fragrance. The plant is also known as white bush poppy and Californian poppy wort.

Camellia is the name given to the shrub *Camellia Japonica*, a plant native of China and Japan belonging to the N.O. Ternstroemiaceæ. The most attractively perfumed species, however, is *C. Sasanqua*, having small leaves and small single white flowers; the plant attains a height of about 15 feet. A fixed oil is expressed from the seeds of this plant which is used locally. The leaves are said to make an excellent hair tonic. In 1911 H. Kimura distilled a quantity of young leaves from which he obtained about 1 per cent of

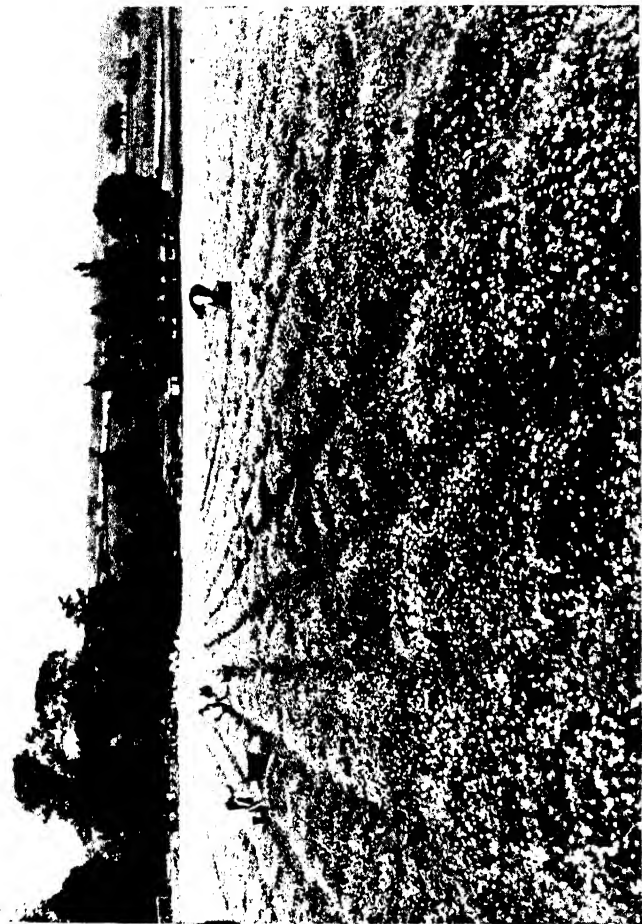
a sweet smelling essential oil. This consisted of 97 per cent eugenol and an ester having an odour reminiscent of geraniol. On the Continent a certain amount of popularity has been enjoyed by camellia perfume. Synthetic ottos bearing this name are usually compounds of linalol, ylang-ylang, and iso-eugenol, blended with jasmin, orange flower, and musk.

Camomile Oil, Roman, is obtained by distillation of the dried flowers of *Anthemis nobilis*, L., N.O. Compositæ. The plants are found growing wild in western and southern Europe and are cultivated particularly in Great Britain, Germany, and Belgium. In England the principal centre of cultivation is at Long Melford, where the double form is specialised in. The inflorescence consists entirely of Ray florets. The flowers yield about 1 per cent of oil, but when the whole plant is distilled this figure is reduced to about 0.3 per cent. The oil is a pale blue or greenish-blue liquid with the characteristic odour of the flowers, and has been recently introduced as a perfume in shampoo powders. It is believed to tint the hair when thus applied. The principal constituents are angelic acid, and its iso-amyl and iso-butyl esters. It has also a limited use as a tobacco flavour.

Camomile Oil, German, is distilled from *Matricaria Chamomilla*, L., plants mainly cultivated in Hungary. The yield is about 0.3 per cent. The characteristic colour of the oil is due to a pigment named *azulene* by Piesse in 1864, and since investigated by Sherndal.¹ The essential oil has been shown by Jama² to occur in two entirely different parts of the inflorescence. From 4 kilos of pure flowers he obtained 14 grams of oil = 0.35 per cent, and from 1 kilo of pure calices 5.1 grams of oil = 0.51 per cent. The oil from the flowers was blue, while that from the calices was faintly green and turned yellow in the course of a few days. Camomile oil is stated to be a suitable

¹ "J. Amer. Chem. Soc.," 37 (1915), 167.

² "Apotheker Ztg.," 24 (1909), 585, through Schimmel's "Report," October, 1909, 37.



[*Stafford Allen & Sons, Ltd.*

FIG. 6. — A field of English Camomile at Long Melford in 1924.

The crop was good but, owing to the absence of sun, the yield of oil was low. This varies from 6 to 18 pounds per acre, and is influenced to some extent by the composition of the soil.

[*To face page 90.*

solvent for platinum chloride and is used for this purpose in the glass and porcelain industries in order to coat vessels with platinum. In fine perfumery camomile is used as a blender in oriental compounds and sometimes in combination with patchouli, lavender, and oakmoss.

Camomile Oil, Moroccan, is obtained from a subspecies of *Ormenis mixta*, L., and from *O. multicaulis*, Braun-Blanquet and Maire, a common annual covering vast expanses of territory in Western Morocco and developed commercially by the well-known firm of C.A.P.P. It has recently been examined by Trabaud and Sabetay¹ who obtained a yield of 0.1 per cent of essential oil, having a bluish-green colour, which with age became progressively yellowish. The odour was similar to that of other camomiles excepting that it had a rosey-honeyed character.

Camphor is a crystalline substance occurring with the essential oil in the wood of *Cinnamomum camphora*, L., N.O. Lauraceæ, a tree indigenous to China, Japan, and the island of Formosa. It is also cultivated in different parts of the world including Ceylon and California. The camphor and volatile oil are removed from the wood by steam distillation, crude apparatus being used. The former is separated from the latter by pressure. Camphor oil contains a large percentage of safrole and is used as the commercial source of this isolate. Purified camphor is prepared by sublimation from a mixture of crude camphor, charcoal, lime, etc. Camphor is also synthetically prepared by the oxidation of borneol, but is easily distinguished by its optical inactivity. It is not much used in cosmetics excepting perhaps when mixed with hard paraffin and sold as "Camphor Ice." 70 per cent of the world's production is employed in the manufacture of celluloid.

Canada Balsam, known also as Canada Turpentine, is a viscous oleo-resin obtained by incision from the balsam fir, *Abies balsamea*, Miller, and the hemlock spruce,

¹ "P. and E.O.R.," January (1939), 13.

A. Canadensis, M., trees widely distributed throughout Northern America and belonging to the natural order Coniferæ. The product of commerce is collected mainly in the province of Quebec. Cavities form on the smooth trunk of the tree and fill with oleo-resin. These are punctured by the pointed spout of a can into which the liquid empties itself. When freshly collected Canada balsam is a clear, transparent liquid, but this becomes more viscous and on exposure eventually dries as a hard resin. It contains about 20 per cent of volatile oil, consisting principally of *l*-pinene.

Canada balsam is a remarkably good fixative for soap perfumes containing a high percentage of citrus oils and may be used up to as much as 10 per cent in Cologne and verberna compounds.

Canadian Snake Root Oil is obtained from the roots of *Asarum canadense*, L., N.O. Aristolochiaceæ, a plant found in Canada and the United States. It grows on rocky ground and in old woods, and is a very insignificant plant, only two leaves and their stalks appearing above ground. A small bell-shaped flower develops close to the ground and in the axils of the two leaves.¹ The plant flowers from May to July.

The rhizome is collected in the spring, deprived of its roots, cleaned and dried. This is known as wild ginger. The yellowish oil has a pungent aroma recalling a mixture of patchouli and ginger, and traces of it are used for imparting special tones to eau-de-Cologne. It has been examined by Power and Lees who isolated a phenol of creosote-like odour, pinene, *d*-linalol, *l*-borneol, *l*-terpineol, geraniol, and methyl eugenol.

Cananga Oil is distilled from the flowers of *Cananga odorata*, Hook,² and probably also *C. latifolia*, N.O.

¹ See illustration in Kraemer's "Economic Botany," 522.

² According to Holtz, *Anona odorata*, Dun, is not a synonym, but a different, although closely allied species. The flowers, however, have the same economic value.

Anonaceæ, trees attaining a height of about 80 feet and growing wild in Java, Reunion, and Southern Asia. They are cultivated at Bantam and in Western Samoa at Apia. The flowers appear when three years old and blossom continuously with suitable alternating conditions of rain and sun, yielding about 120 kilos of flowers. Practically all Javanese oils are made by water distillation when the yield is 1 per cent. Prolonged treatment increases this by 50 per cent. The Javanese oils come from Serang and Cheribon, that from the latter is now better known and more appreciated on account of its less penetrating odour. According to de Jong,¹ the distilleries at Serang are away from the plantations, and the apparatus consists of copper boilers, etc., into which the bruised flowers are introduced. Gin bottles are used as receivers instead of Florentine flasks. Every parcel of flowers is distilled continuously for two days, and during the second day the cooling is very imperfectly done. Cananga oil has a sweet pleasant aroma, but not by any means as fine as that of the oil distilled from the same tree grown in the Philippines and known as ylang-ylang oil. This is a remarkable example of the difference in odour value, due probably to the soil or climatic conditions under which the plant grows. As de Jong has pointed out, however, the differences may be due to minor botanical differences in the trees. Schimmel & Co. are of the opinion² that it would be possible to obtain ylang-ylang oil from cananga flowers in Java if the flowers were not crushed, and if, instead of water distillation, distillation by water and steam were applied. Bobiloff³ has since been able to distil ylang-ylang oil at Buitenzorg, but when the stills were taken to Serang and Cheribon and the flowers collected on the spot, the oil yielded was not of the same aromatic quality, but compared only with the normal cananga of commerce. Bobiloff was unable to explain this anomaly. In Reunion the first fractions are

¹ Schimmel & Co., "Report," April (1909), 26.

² "Report," April (1909), 29.

³ "Bulletin Teysmania," 7-8, 1922.

said to yield ylang-ylang oil and the second runnings cananga oil. The latter contains a higher proportion of terpenes and a lower ester value. Among the important constituents so far identified are the following : linalol, geraniol, para-cresol methyl ether, cadinene, safrole, nerol, farnesol, eugenol, iso-eugenol, methyl-eugenol, benzyl acetate and benzoate, and methyl salicylate and anthranilate. The terpeneless oil, which is from two to three times the strength of the natural oil, is sometimes sold as synthetic ylang-ylang. It is undoubtedly a useful asset in preparing this oil as the following example will show :—

500	Cananga terpeneless.
70	Methyl eugenol.
20	Methyl anthranilate.
30	Methyl salicylate.
130	Phenylethyl alcohol.
250	Linalol.
<u>1000</u>	

Cananga oil is a valuable soap perfume, being used in floral odours such as jasmin, violet, and lilac—*see also* Ylang-Ylang Oil.

Canarium Luzonicum Oil—*see* Elemi.

Candleberry—*see* Waxes.

Canella Oil is distilled from the bark of *Canella alba*, Murray, N.O. Canellaceæ, a plant grown in the West Indies. Its odour is very aromatic, and recalls that of cinnamon and clove simultaneously. It is used in Eastern bouquets.

Cantharidin is a tasteless, odourless, crystallisable solid, only sparingly soluble in water and obtained from cantharides, the dried beetle *Cantharis Vesicatoria* and other blistering beetles. It is used in hair preparations, and for this purpose is usually dissolved in chloroform or æther before being added to the bulk.

Caparrapi Balsam is obtained by incision from the

trunk of *Laurus giganteus*, a large evergreen forest tree of the N.O. Lauraceæ. It derives its name from the village of Caparrapi in the province of Cudinamarea in the United States of Columbia. The balsam is described by Bayón¹ as having an aromatic odour and varying in colour according to the age of the tree, but usually resembling balsam of tolu. It appears to be used locally for all kinds of medicinal purposes, and were it a commercial article would probably find some use in perfumery.

Capé Oil was first distilled by Roure-Bertrand Fils in 1911 from the leaves of *Popowia capea*, Camus, a plant of the N.O. Anonaceæ found growing in the Ivory Coast of French West Africa. The dried leaves yielded 0.59 per cent of a greenish-yellow mobile oil which distilled over in light and heavy fractions. In odour this first resembled patchouli and after evaporation was more powerfully aromatic. The plant is used by the natives as a perfume and also as a bath, this being prepared in a very primitive manner by macerating the crumbled leaves and stalks in cold water. Providing sufficient raw material could be obtained in regular supply, capé would appear to offer a very valuable raw material for perfumery.

Caprinic Alcohol—see Decyl Alcohol.

Caprinic Aldehyde—see Decyl Aldehyde.

Capronic Aldehyde—see Hexyl Aldehyde.

Caprylic Aldehyde—see Octyl Aldehyde.

Caraway Oil is obtained from the seed of *Carum carvi*, L., an erect biennial herb of the N.O. Umbelliferae, widely distributed throughout Europe and Northern Africa. The plant is cultivated extensively in Holland and to some extent also in England. The volatile oil distilled from the latter is generally considered to have the finest aroma. In Holland caraway seems to have been first cultivated about

¹ "Pharm. Journ.," 3rd Series, 23, 1045.

the year 1815, and progress has been steadily increasing until to-day about 6000 acres are under cultivation. The plant requires a fertile clay soil and the seeds are sown in the early spring. According to Zijlstra¹ sowing is usually carried out along with a cover crop. This cover crop must ripen early, for it is only after its removal that the young caraway plants can develop properly. Generally beans, peas, mustard, flax, or clover are chosen as cover crops. Recently spinach has been tried with success. Harvesting takes place between the end of June and early July as soon as the fruits begin to become brown on the umbels which were first to flower. Great care is necessary in collection in order to avoid loss of seed. Threshing is done by machinery almost always. The yield is about 15 cwt. per acre.

Caraway oil consists principally of **carvone** together with limonene. It is not widely used in perfumery, but in toilet soap manufacture it has a very useful application. In combination with cassia oil it yields very pleasant brown Windsor perfumes, the percentage being in the neighbourhood of 5 to 10. In small quantities it is useful in combination with other oils for flavouring mouth washes.

Carbitol—*see* Diethylene Glycol Monoethyl Ether.

Carbolic Acid, known also as phenol, $C_6H_5.OH$, is obtained by the fractional distillation of coal tar with subsequent purification. It occurs in "detached" colourless, deliquescent crystals melting at $42^\circ C$. This is the purest form used in dental preparations. "Ice" crystals contain traces of impurities and melt at $39^\circ C$. On exposure to the atmosphere, phenol will assume a pinkish colour which is due to the formation of some coloured derivative. Phenol is used in dentrifices, but should always be added in solution to ensure even distribution of the substance. *See* Carbolic Tooth Powders in Volume II.

¹ A paper quoted at length by Schimmel & Co., "Report," October (1915), 10.

Carbon Tetrachloride, CCl_4 , is a liquid having a sweetish nauseating odour. It has been used as a non-inflammable liquid hair and scalp cleanser when perfumed with lavender, but owing to its odour is not recommended. It has S.G., 1.602, and B.P., 77°C .

Cardamon Oil is generally distilled from the seeds of Ceylon cardamons, *Elettoria Cardamomum*, Maton, a reed-like perennial plant of the N.O. Scitaminæ found growing wild near the Malabar coast of Southern India and much cultivated there and in Ceylon. Here the area under cultivation is estimated at about 7000 acres situated in the mountainous districts north-east of Kandy, at elevations of between 3000 and 4000 feet. The entire fruit is generally met with in commerce, but occasionally the seeds freed from their pericarps reach the European distiller. Cardamons have been known since the earliest times, but it is very doubtful if the same species was referred to in the works of Theophrastus, Pliny, and Dioscorides. In Pomet's "Histoire des Drogues" (1694) three varieties of cardamons are described, but apparently the "great cardamon" refers to Grains of Paradise. Two varieties of cardamons are cultivated in India, i.e., Mysore and Malabar. The former is the more esteemed variety as it yields a higher percentage of oil.¹ The name of an Indian Province used to describe a variety cultivated in Ceylon is curious and does not appear to have been explained. The cardamons are distinguished by their smooth ovoid shape and creamy colour; the malabars by their rough, shorter capsules.

The cultivation and commerce of both varieties has been described in detail by a much-esteemed British periodical.² More recent information³ indicates that the plants are put between tea and rubber plants and do not require much attention or manuring. They bear in the second year.

¹ See paper by E. J. Parry, "Year Book of Pharmacy" (1899), 457.

² "Chemist and Druggist," 80 (1912), 367.

³ Schimmel's "Report" (1918), 16.

The flowering time is in April or May and the fruits are collected in September or October. They are generally dried in the open air, trimmed by machines, sieved into various sizes, sorted to tint and finally bleached with sulphur vapours. The seeds yield about 5 per cent of essential oil of characteristic odour while the roots yield about 0.6 per cent of an oil of entirely different and more aromatic odour.¹ The powdered seeds are occasionally used in the manufacture of incense and fumigating powders when liberal quantities of cascarilla and santalwood are added. In traces the essential oil gives a peculiar and characteristic note to eau-de-Colognes, jasmin, and chypre perfumes, but much discretion is required in its employment. It is also recommended as a useful constituent of lily of the valley perfumes. This would appear to be based on the suggestion of H. Soxhlet who published the following formula in "Zeitschr. des Österr. Apoth. i. Ver." (1892), 360 :—

200	Extract of jasmin.
100	„ ylang-ylang.
200	Alcohol 95 per cent.
5	Powdered cardamons.
<u>505</u>	

After maceration for two days, this is stated to possess in a remarkable degree the odour of *Convallaria majalis*.

Carmine is prepared by precipitating decoctions of cochineal with alum, gelatine, etc., and is readily soluble in alkaline liquids. The exact details of the process are a carefully guarded trade secret, but the results are said to be dependent upon fine dry weather. It occurs in light, bright red pieces which are easily reduced to powder. Carmine contains about 50 per cent of carminic acid and is frequently used in toilet preparations, lip salves, rouges, etc. For some articles it is replaced with advantage by a dye known as **Carmoisine**, certain varieties of which are not altered in acid solution. Carmine is much used for tinting

¹ Compare "Schimmel's Report," October (1911), 105.

other liquids, and is then best employed in solution. A good formula is as follows :—

75	Carmine.
400	Liquid ammonia.
400	Glycerine.
125	Water.
<u>1000</u>	

Dissolve the carmine in the liquid ammonia and add the glycerine. Heat on a water-bath until all free ammonia has been expelled, cool and add water to produce 1000. This solution should not exhibit the peculiar purplish fluorescence associated with alkaline solutions.

Carnation, or *Dianthus Caryophyllus*, is one of our most beautiful garden flowers whose perfume is now fairly easily duplicated synthetically owing to the number of organic bodies arising from clove oil having an odour closely approximating that of the flower. The best fixative for this type of perfume is benzyl iso-eugenol. For further details reference should be made to the monograph in Volume II. Carnation absolute is an article of commerce and is used only in the most exclusive perfumes. It is very costly and occurs as a concrete oil melting at 52° to 55° C. In 1923 A. Chiris distilled the fresh pink flowers with steam and obtained 0.003 per cent. of a light green oil having a powerful fragrance reminiscent of aliphatic aldehydes.

Carob Seed Gum is obtained from the bean of *Ceratonia Liliqua*, a small branched tree of the N.O. Leguminosæ, attaining a height of 20 or 30 feet, and found growing in the countries bordering the Mediterranean, Syria and Western Asia. The flowers have an unpleasant smell and the fruit is a pod of 6 or 8 inches length, not unlike a broad bean. These carobs are considered by some authorities to be the "husks" referred to in the New Testament as eaten by the Prodigal Son, and the "Locusts" that St. John lived upon in the Wilderness, hence the name

St. John's Bread tree. The gum appears in commerce as a white powder, swelling with cold water and forming a uniform mucilage on heating. This, by the way, ensures the destruction of the enzyme sometimes associated with the mother substance. Borax increases the viscosity of the mucilage which is used very much in the same way as tragacanth.

Carotene (Carotin), $C_{40}H_{56}$, is a yellow colouring matter, widely distributed in nature, particularly in such edible products as carrots and tomatoes. Known also as pro-vitamin A, it is converted by the animal organism into vitamin A in the liver. Carotene finds application as an active ingredient in rejuvenating cosmetics, such as creams for the reduction or elimination of wrinkles. It appears that in its uncompleted form, vitamin A possesses a greater local activity, and in oil solutions is more readily absorbed through the skin by local application.

Carrageen, or Irish moss, is the whole plant, *Chondrus crispus*, Stackhouse, N.O. Gigartinaceæ. It is really a seaweed found growing just below low-water mark on the northern shores of the Atlantic; the principal source of the European drug being the coasts of Brittany and north-west Ireland. Carrageen contains about 90 per cent mucilage, and on this account is used as the basis of cheap skin creams where tragacanth would be too expensive. For this purpose the plant is boiled with water for half an hour and then strained—the liquid setting to a jelly when cold. A small percentage of this mucilage in vanishing creams increases the adhesive qualities of the product.

Carrot Seed Oil is generally obtained by distillation from the seeds of *Daucus carotta*, L., N.O. Umbelliferæ, the common carrot, cultivated in Maine and Loire districts of France and also largely in Provence. The crop is collected during August and the seeds separated by special beaters, which give rise to two different products—the marketable seeds and also a so-called "dust" containing

the ground aggregate of the ripe seeds and from 2 to 5 per cent of seeds. The yield is about 1000 kilos per hectare. According to G. Igolen¹ steam distillation of the seeds yields from 0.8 to 1.6 per cent of oil, according to the variety used. It is a limpid yellowish-white liquid varying slightly in odour according to whether it comes from the seed or the "dust". It possesses an odour of orris type, having a shading of patchouli and blends well with all violet ketones. For obtaining a new note or for shading an otherwise ubiquitous perfume this oil offers undoubted possibilities. A fairly good imitation of orris is obtained by blending this oil with cedarwood. The chemistry of carrot seed oil is still obscure.

Carthamin is the red colouring matter of safflower, *Carthamus tinctoria*, L., a prickly stiff-leaved annual of the N.O. Compositæ, about 2 feet high, producing spiny heads of red flowers and cultivated in the East, particularly India and China. The plant is also grown in the Levant, Egypt, and Southern Europe, and is stated to have been introduced in Britain nearly 400 years ago. Safflower is known as cardoon and bastard saffron and has been much used as an adulterant of genuine saffron. It was known to Pomet as German saffron, and in his "Histoire des Drogues" he says that it was in great vogue among the feather sellers and for making Spanish red. It was much used in later years for dyeing china, silks, crapes, and Spanish wool. Their preparation is thus described by Cooley:—²

"Take of safflower any quantity, and soak and wash it in pure water or in water very slightly acidulated with citric or acetic acid until the water comes off perfectly colourless and ceases to remove anything."³ Then drain and dry the

¹ "Les Parfums de France" (1936), 178.

² "A Practical Treatise on Perfumery." Philadelphia, 1874.

³ Safflower contains two colouring matters, the one yellow and the other red. The former is water soluble, and this part of the process was evidently intended for the removal of the yellow pigment—giving a brighter red on subsequent treatment.—W. A. P.

washed safflower, coarsely pulverise it, and digest the powder until exhausted in a weak solution of crystallised carbonate of soda. Next place some washed fine cotton wool (or pieces of clean white muslin or calico) at the bottom of a glass or porcelain vessel ; pour the last solution, previously filtered or decanted, over it, and gradually add dilute acetic acid or a solution of citric acid (some prefer lemon juice) in slight excess or until the whole of the colouring matter is thrown down, the cotton wool being stirred about all the time, in order that it may receive the colour as precipitated. Collect the prepared cotton carefully but thoroughly, wash it in pure water and dissolve out its colouring matter with a fresh solution of carbonate of soda as before. To this last solution placed in a suitable glass or porcelain vessel add a quantity of talc or French chalk proportionate to the intended quality of the rouge. Mix them well and again precipitate the colouring matter with acid. Collect the powder, wash it and dry it in the shade with as little heat as possible. Lastly triturate it with a few drops of almond oil or olive oil to increase its smoothness and adhesiveness."

Fifty years ago this was the method *par excellence* of preparing theatrical rouge.

Carvacrol, $C_{10}H_{14}O$, is a phenol isomeric with thymol, and occurs in origanum and thyme oils. It is powerfully antiseptic and may be employed in dental preparations. It has S.G., 0.981, and B.P., $236^{\circ} C$.

Carvene is the name given to the residues left after the carvone has been abstracted from caraway oil. It consists principally of limonene.

Carvone is a ketone occurring in the essential oils of caraway, dill, and spearmint. It is used as a flavouring agent. It has the formula $C_9H_{13}CHO$. S.G., .965 ; B.P., $230^{\circ} C$.

Caryophyllene is a sesquiterpene occurring naturally in several essential oils and notably in that of cloves.

Frequently it is the name given in commerce to clove oil, from which the eugenol has been abstracted in the preparation of this phenol and also in the manufacture of vanillin. To the soap perfumer it is often sold as "light" clove oil, and is a useful adjunct in the preparation of cheap soap perfumes.

Cascarilla Oil is distilled from the bark of *Croton Eleuteria*, J. J. Bennett (and possibly also *C. Cascarilla*), a small tree of the N.O. Euphorbiaceæ indigenous to the Bahama Islands and Florida. It possesses an aromatic cinnamon pepper-like odour characteristic of the bark, and can be used to replace the latter in fumigating mixtures. Generally, however, the powdered bark is used for this purpose. As far back as 1693, Stisser records the fact that it was customary in this country to mix cascarilla bark with tobacco "for the sake of correcting the smell of the latter when smoked." Cigars and tobacco are sometimes perfumed with a strong tincture of the bark mixed with tincture of benzoin. Cascarilla bark contains about 1 per cent of volatile oil containing eugenol, amonene, etc., and cascarillin, vanillin, and 15 per cent of resin—see Incense and Tobacco in Volume II.

Cascarilla gratissima is a South African species which is said to bear extremely aromatic leaves. They are used by the Koras as a perfume.

Casein is the nitrogenous constituent of milk. The solid protein is separated by the addition of a weak acid or by means of rennet. In perfumery it is used principally as the basis of many rolling massage creams, and when thus employed should be freshly prepared. Casein is used industrially in the preparation of washable distemper, paints, and artificial ivory.

Cassia Aldehyde—see Cinnamic Aldehyde.

Cassia Oil is distilled from the leaves and twigs of *Cinnamomum cassia*, Blume, a plant of the N.O. Lauraceæ,

indigenous to Cochin China and now extensively cultivated in China, particularly in the provinces of Kwang-si and Kwang-tung. According to a report of the Consul-General of Canton¹ the trees are propagated in nurseries and when a few inches high are transplanted to the slopes of open hills. In the course of six or seven years they attain a height of about 8 feet, the trunk measuring 5 inches in diameter. Between April and June these are cut down to the root and the stump covered with earth. This process and re-growing is repeated every six years until the tree dies (said to be thirty years). Cassia bark is obtained from the trunk of the tree while the branches and leaves as well as the bark which falls off are employed for distilling cassia oil. The exhausted raw material is said to be used as fuel for heating the stills. Cassia is also known as **Chinese Cinnamon** and was regarded formerly as a poor quality cinnamon. No such confusion appears to have existed at the time of Theophrastus, Dioscorides, and Pliny because in their works they treated the two as distinct, although closely allied, substances. It will have been observed that cassia is mentioned in at least two places² in the Scriptures. Commentators are of the opinion that the former probably refers to the cassia of to-day and the latter to either orris or costus.

The following bodies have so far been identified in cassia oil: Cinnamic aldehyde, cinnamyl acetate, phenyl propyl acetate, methyl ortho-coumaric aldehyde, salicylic aldehyde, coumarin, benzoic acid, salicylic acid, benzaldehyde, methyl salicylaldehyde. It is usually bought on its cinnamic aldehyde content which for the finest oils should be 85 to 90 per cent. This aldehyde readily oxidises to cinnamic acid which attacks the lead container. Cassia oil, therefore, is prone to contain lead and should be rectified before use. It is used as a blender in the heavier type of perfumes, but more particularly in the soap industry as the basis of brown windsor perfumes. A product

¹ Through Schimmel's "Report," April (1910), 31.

² Exod. x. 23, 24; Ps. xlv. 8,

closely resembling the original may be compounded as follows :—

150	Cassia oil.
100	Clove oil.
80	Caraway oil.
20	Cinnamon leaf oil.
100	Spike lavender oil.
100	Red thyme oil.
100	Rosemary oil.
350	Bergamot oil.
<u>1000</u>	

Cassia should not be confused with **Cassie**, the product of *Acacia farnesiana* (which *see*).

Cassie is a well-known and highly esteemed perfume-giving flower, the concrete or pomade being obtained from *Acacia farnesiana*, N.O. Leguminosæ, a shrub cultivated in the South of France. There is a forest of bushes in Syria, near Beyrouth, where a works has been established by a well-known French firm. The concrete is extracted on the spot and then sent to Grasse for the production of absolute. This product has a most exquisite odour and is used in fine violet perfumes and other bouquets. The odour of the fresh, golden, globular flowers recalls both violet and orange blossom simultaneously. Farnesol and methyl salicylate, among other substances, have been detected in the extract. For formulæ and other details reference should be made to the monograph in Volume II.

Cassie Ketone—*see* Anisyl Acetate.

Cassis Concrete—*see* Black Currant Concrete.

Castile Soap was at one time the description of a soap made from olive oil of lower grades and caustic soda. It consisted mainly of sodium oleate, the better qualities being white in colour and the poorer specimens greenish. There appears to be very little doubt that numerous samples of so-called “castile soap” on the market to-day are made from various oils such as coco-nut, sesame, etc., and also from tallow. The genuine article can still be obtained from

reliable sources. Hard soap is the more generally adopted description.

Castor (Castoreum) is the dried preputial follicles and their secretion obtained from the beaver, *Castor fiber*, L. Two commercial varieties are recognised, Canadian and Russian, the former coming principally from the Hudson Bay Company's territory. Up to 1929 an annual auction sale of the pods was held in London and this totalled between £5000 and £6000. This has now been discontinued, the company preparing an extract on the spot and exporting it as such. The two pear-shaped membranous sacs are found in both male and female, and should not be confounded with the male genital organs; they are in fact situated between the anus and the sexual organs. Castor, when fresh, is said to contain a creamy secretion, but when dried in the sun or smoked this turns to a reddish-brown resinous substance. The drug has been examined by a number of chemists who have obtained varying results probably owing to the age of the animal and its environment at the time of collection. Most are agreed, however, that it contains a crystalline principle—castorin—together with resin, benzoic acid, and a volatile oil containing benzyl alcohol, acetophenone, *p*-ethyl-phenol, *l*-borneol and possibly a lactone. The odour of castor is not by any means pleasant, indeed it has been variously described as strong, objectionable, etc., but in general resembles birch tar and becomes more pleasant on dilution. It is generally employed as a tincture. This is prepared by removing the secretion from the bags and rubbing it down with either orris root powder or clean silver sand. It is then macerated for several days with twenty times its weight of 90 per cent alcohol and afterwards filtered bright in the cold. The soluble fraction of the sacs equals from 45 to 75 per cent of their original weight. The dark colour of the tincture is a decided disadvantage, and when musk and civet are plentiful it does not find a wide application in perfumery.



FIG. 7.—The Canadian Beaver. *[Les Partiums de France.*
[To face page 100.

As mentioned above the extract of castoreum is now generally sold. Such absolutes, prepared by the Grasse firms, are of excellent quality and save all the usual preparations for the making of a tincture. Benzene and ethyl alcohol are used as extractive agents, the former yielding about 20 per cent of so-called concrete. The latter yields the resinoid or absolute. It is merely dissolved in alcohol; about $2\frac{1}{2}$ to 5 per cent being the usual strengths employed by perfumers. It may be employed as a fixative in the heavy type of Oriental or chypre bouquet, and is sometimes used in compounding artificial ambers. Castor has evidently been used since early times, and the following extract from Pomet's work¹ will indicate the methods practised in adulterating it:—

“The dearthness of castor and the avarice of wicked persons have induced people to counterfeit it, which they do by mixing the powder of true castor with gums” that there is no necessity of naming and putting them in skins, which have contained the testicles of lambs and goats; then they hang them in the chimney and pass them off as true castor.”

Castor Oil is expressed from the seeds of *Ricinus communis*, L., N.O. Euphorbiaceæ, a plant indigenous to India but now cultivated in other subtropical countries. Castor oil is the raw material from which are prepared cœnanthic aldehyde, amyl cinnamic aldehyde, gamma undecalactone, and methyl heptene carbonate. Mixed with alcohol, perfumed and tinted, it is sold as a hair fixer. Castor oil is an important constituent of lipsticks, not only acting as a solvent for eosine, but imparting a quality of spreading like velvet unobtainable with any other substance. It is also an important constituent of transparent soaps.

Cayenne Linaloe Oil—see Bois de Rose Femelle.

Cedarwood Oil is obtained by the distillation of the wood of *Juniperus virginiana*, L., N.O. Pinaceæ, a shrub

¹ “Histoire des Drogues,” 1694.

² Lemery mentions ammoniacum.

or lofty tree widely distributed in North America. The wood has been used from time immemorial and was valued on account of its durability in the time of Solomon and also by the King of Assyria who obtained cedarwood for building his palace in Nineveh. The oil of commerce is generally distilled from the wood of the above-mentioned species and not infrequently from the shavings produced in lead pencil works. Recently a factory has been built in America in which the waste wood from cedarwood box-making is utilised for the production of an oil which answers the highest requirements. Comparatively small quantities of oil are distilled also in England and Germany. Numerous other species, however, are known as cedarwood.¹ The oil has a pleasant soft fragrance characteristic of the wood and on account of its cheapness it finds extensive application in the soap industry. It is the basis of many perfumes such as violet and cold cream, of which the following is a typical example :—

300	Cedarwood oil.
120	Clove oil.
80	Cassia oil
400	Bergamot oil.
30	Benzaldehyde.
50	Phenylethyl alcohol.
20	Musk xylene.
<u>1000</u>	

It has also been found as an adulterant of ionone and is used occasionally in eau-de-botot.

Cedarwood Oil—Atlas—see under A.

Cedrat Oil, as met with in commerce, is usually a mixture of *Citrus* oils. The citron, from *Citrus medica*, Risso., N.O. Rutaceæ, yields an oil from the peel, which resembles lemon oil. For the varieties and full details consult the papers by Gulli.² Enquiries during the author's visit to

¹ Consult "Kew Bulletin" (1913), 207.

² "The Chemist and Druggist," 60 (1902), 19 and 62 (1903), 22, 454.

Calabria in 1938 showed that approximately 20 kilos of genuine oil could be obtained to order annually, whereas several hundred kilos are in fact exported.

Cedrela Wood is the product of *Cedrela odorata*, L., and other species of the N.O. Meliaceæ, large trees indigenous to Central America and the West Indies where the wood is used in the manufacture of cigar boxes. An essential oil has been distilled from different species which possesses an odour reminiscent of cedar. It should not, however, be confused with *Juniperus virginiana*, L., which yields the cedarwood oil of commerce. An oil from *Cedrela toona*, Roxh., has recently been examined by Pillai and Rao,¹ who found it to contain copæne, 35 per cent, cadinene and other dicyclic sesquiterpenes, 45 per cent, and cadinol 13 per cent. The tree grows to a height of 100 feet and is found mainly at an altitude of about 8000 feet in the Himalayas. It is known locally as Red Toon or Indian mahogany.

Cedrenol is a primary sesquiterpene alcohol occurring in cedarwood oil.

Celery Seed Oil is obtained from the ripe seeds of the cultivated variety of *Apium graveolens*, L., a plant belonging to the N.O. Umbelliferae and much cultivated in the neighbourhood of St. Rémy-de-Provence. According to E. Meunissier² this plant was introduced there by the inhabitants of Nîmes. The seeds are sown about the middle of July and transplanted in the middle of November. Heavy manuring is necessary, and the crop is collected during the following August, the herb being cut, dried and thrashed. The yield is about 8 cwt. of seed per acre. Quantities of seed are exported via Marseilles. The oil has been subjected to a detailed analysis by Schimmel & Co.³ who found it to contain 70 per cent of hydrocarbons and about 3 per

¹ "J. Soc. Chem. Ind.," June 26 (1931).

² "Parfumerie Moderne," 18 (1925), 270.

³ "Report," April (1910), 32.

cent alcohols. The oil has a peculiar aromatic odour characteristic of the plant, and may be used for obtaining a new note in handkerchief perfumes, *e.g.* sweet-pea and tuberose. It possesses a very persistent odour and is pale yellow in colour.

Celluloid is an intimate mechanical mixture of camphor and pyroxylin, prepared by partially dissolving each substance in a suitable solvent (*e.g.* carbon tetrachloride, methyl alcohol, amyl acetate or acetone), mixing, and subjecting to pressure. By dissolving up to 4 per cent of white celluloid in a mixture of acetone and amyl acetate, suitably perfumed, an excellent **Nail Varnish** is produced. *Compare* Nitro Cellulose.

Cera Alba—*see* Reeswax.

Ceresine is obtained from crude ozokerite, a mineral wax occurring in Galacia and Tcheleken Island in the Caspian Sea. It is found admixed with earthy impurities and is purified by repeated treatment with sulphuric acid. This forms the yellow ceresine of commerce. It is bleached by filtration through special earth and in this form is useful in several toilet preparations. Genuine samples should melt between 60° and 80° C., but the lower melting-point specimens are generally preferred. Ceresine finds wide application in the manufacture of boot polishes.

Ceryl Cerotate is the chief constituent in Chinese insect wax (*which see*). It is a wax-like body resembling spermaceti in appearance and possesses the remarkably high melting-point of 84° C. It has recently been prepared synthetically and is marketed under the name Rilan wax. In other industries it is a useful substitute for Carnuba wax, whilst its hardness is made use of in cosmetics, such as eyebrow pencils and lipsticks.

Cetaceum, or spermaceti, is a concrete fatty substance obtained from the head of the sperm whale, and is separated from the admixed sperm oil by freezing and hydraulic pressure. When refined with dilute caustic soda solution it

becomes almost neutral. Spermaceti has a lustrous crystalline structure, consists almost entirely of cetyl palmitate (cetin), and melts about 45° C. It is of value in the manufacture of both liquid and solid creams and is the basis of many lip salves.

Cetyl Alcohol, $C_{16} \cdot H_{33} \cdot OH$, is a tasteless, odourless, waxy, scaly powder having a melting range from 48° to 49° C. and an acid and ester value of 0. It is completely stable in the presence of acids, alkalies, light and air, and readily soluble in alcohol, ether, carbon disulphide as well as in glycol and diglycol ethers. It is completely miscible with mineral and vegetable oils and fats. This compound may be produced by saponification of the cetyl palmitate found in spermaceti or indirectly from coco-nut oil. It is useful in both "oil in water" and "water in oil" emulsions, and from 1 to 5 per cent in many cosmetics is said to enhance the smoothness of the skin.

Chalk (Precipitated), $CaCO_3$, is a fine white powder composed of odourless and tasteless microscopic crystals of calcium carbonate. It is obtained by adding a solution of sodium carbonate to a solution of calcium chloride. The powder should be free from grittiness and contain no coarse particles. It is used principally in the preparation of dentifrices and to some extent in face powders.

Chalk (Prepared) is native calcium carbonate purified by elutriation. It generally enters commerce in small conical pieces, and is used in cosmetics in the preparation of compact powders.

Champaca Oil may be obtained by distillation from the fresh flowers of either *Michelia champaca*, L., or *M. longifolia*, Bl., large trees of the N.O. Magnoliaceæ found growing in the Philippines, Java, and Northern India. The flowers of the former variety, which have a delicious fragrance, are pale lemon coloured and tulip shaped while those of the latter are white. They are used to ornament the hair both of men and women and are

said to be sacred to one of the Hindu gods (Vishnu?). Both species are cultivated in the Indo-Malayan region as are also *M. fuscata* and *M. nilagirica*. Only the two first mentioned, however, occur in sufficient quantity to yield oil of commercial importance. At one time this was fairly easily obtainable, but genuine oil is to-day very scarce being limited to a few kilos per annum, almost all of which is employed in fine jasmin flower perfumes. The products distilled from *M. champaca* and *M. longifolia* are quite distinct in odour and constituents; that from the former is very fragrant and slightly fluorescent; that from the latter is more fruity. It appears doubtful whether commercial oils are distilled from the yellow flowers alone or from a mixture of the two with a possible addition of ylang-ylang blossoms. The trees blossom after the fifth year and then only for three months during the year. Lemon-grass is cultivated between the Champaca trees. According to B. T. Brooks, who has published two extensive papers¹ on this subject, the oil from *M. champaca* contains cineol, *p*-cresol methyl ether (?), benzaldehyde, benzyl alcohol, benzoic acid, and phenylethyl alcohol, while that from *M. longifolia* contains linalol, methyleugenol, methylacetic acid and a phenol having an odour of thymol. Other chemists have demonstrated the presence of iso-eugenol, geraniol, and methyl anthranilate. Champaca leaf oil is said to be prepared on a large scale in Java. The odour of the oil recalls that of basil. The majority of champaca perfumes are prepared artificially from the above-mentioned bodies, and these may be suitably fixed by means of ambrette oil, benzyl iso-eugenol, vanillin, olibanum, or tolu balsam.

Champaca Wood Oil—see Guaiacum Wood Oil.

Champacol is a crystalline alcohol melting at 91° C. and having an odour of tea roses. It occurs naturally in the oil distilled from guaiac wood (*which see*).

¹ "Philippine Journ. of Sc.," 6 A. (1911), 333, and "J. Amer. Chem. Soc.," 33 (1911), 1763.

Changala—*see* Costus.

Charcoal (Wood) is prepared by heating different woods to redness in an enclosed space. Willow is generally used in Britain. Charcoal is used in some tooth powders and also in the manufacture of incense and fumigating pastilles.

Chassis—*see* Enfleurage, and also Volume II.

Chavicol, $C_6H_{10}O$, is an aromatic phenol occurring naturally in bay and other essential oils.

Cheiranthus Cheiri—*see* Wallflower.

Cherry Kernel Oil of American origin has been recommended for use in cosmetics. It is expressed from machine-separated kernels and before refining is brownish-yellow in colour with a nutty odour. After purification the colour becomes pale golden and the taste bland. The keeping qualities are alleged to be good.

Chèvrefeuille—*see* Honeysuckle.

Chloramine, $CH_3 \cdot C_6H_4 \cdot SO_2 \cdot N \cdot NaCl + 3H_2O$, is a yellowish crystalline powder, having a slight chlorine odour and yielding up to 13 per cent of that active halogen. It is soluble in water and melts at 160° to 180° C. Known also as chloramine T, it has highly antiseptic properties which are utilised in solid deodorants to the extent of about 1 per cent.

Chloranthus Inconspicuus is a Chinese shrub, Chu Lan Hwa, and its blossoms are known as the "pearl of flowers." They are used for perfuming tea and in the manufacture of modern Chinese cosmetics.

Chloroform, $CHCl_3$, is a volatile liquid used mainly as an anæsthetic. It has, however, a limited use as a sweetening agent in dental preparations. S.G., 1.485; B.P., 60° C.

Chlorophyll is the green colouring matter occurring in the leaves and stalks of plants. Commercially it is extracted from both nettles and spinach by percolation with a volatile

solvent, this being eventually removed by distillation at low temperatures, or by treatment with dilute alkalis and precipitation by mineral acids. Chlorophyll has been largely replaced by dyestuffs when required for colouring aqueous or spirituous preparations and soaps. As a pigment for tinting oils, however, it still has a fairly extensive use. Since it is inclined to precipitate, long standing and decantation are most desirable.

Chlorstyrole, $C_6H_5 \cdot CH : CHCl$, is obtained by the action of alkali on dichlor-ethyl benzene. It is an aromatic liquid of hyacinth odour but not so fine as bromstyrol (*which see*).

Chob-i-qut—*see* Costus.

Cholestrin or **Cholestrol**, $C_{26}H_{44}O$, is a white odourless substance which crystallises with water in pearly plates and melts at $148^\circ C$. It is insoluble in water but dissolves in ether and hot alcohol. This lipoid occurs in the glandular secretion of the human body and as ester in lanoline. Since the piliferous glands secrete cholestrol, it would seem to be an indispensable nourisher for hair growth. Consequently alopecia may be attributable indirectly to a lack of cholestrin. Thus this substance, after much experiment, has been found to be a most valuable product for use in hair preparations. Moreover, its use in skin creams is also an accomplished fact. The difficulty of solution is one which requires experiment on the part of manufacturers who propose to use cholestrol in liquid shampoos, when the articles referred to below should be consulted.¹

Chrysol is a name given to the principal constituent of chrysanthemum oil.

Chypre perfumes have a considerable vogue owing to

¹ "Chemist and Druggist" (8/11/30), 579; "P. and E.O.R.," April (1931), 107; "American Perfumer," Jan. (1931), 693; Sept. (1933), 348.

their remarkable strength and persistence. They are based very largely upon oakmoss, patchouli, labdanum, and clary sage, the flowery note being imparted with rose, jasmin, etc. Bergamot or lemon is a desirable addition, to give the perfume a first sweet note of appeal. For further details consult Volume II.

Cineole, $C_{10}H_{18}O$, also known as **Eucalyptole**, is a constituent of many essential oils, notably those of eucalyptus, cajuput, and spike lavender. It has even been shown to be present in basil, champaca, and bois de rose oils. It is used to some extent as a flavour in dental preparation (also medicinally).

Cinnameine—*see* Benzyl Cinnamate.

Cinnamic Acid, $C_6H_5 \cdot CH : CH \cdot COOH$, is found as such, and also in combination, in several essential oils and gum resins, notably in those of cassia, tolu and Peru balsams, and storax. It may be synthesised either by heating together benzylidene chloride and sodium acetate, or by mixing together under suitable conditions benzylidene acetone, soda, and bleaching powder, the resulting sodium cinnamate being decomposed with sulphuric acid. Cinnamic acid is a crystalline body melting about $134^{\circ} C$. It has a pleasant balsamic smell and is used as a fixative in Eastern perfumes. It is a good stabiliser in soaps.

Cinnamic Alcohol, $C_6H_5 \cdot CH : CH \cdot CH_2OH$, as sometimes met with in commerce, is a pleasant hyacinth-like oil, although in the pure state it is crystalline and melts at $33^{\circ} C$. It occurs as ester in several essential oils, in balsam of Peru and storax. It is useful in combination with phenylacetic aldehyde in preparing hyacinth, lily, and lilac perfumes, while in artificial rose otto it is of value. It may be prepared synthetically, and its methyl and ethyl esters are remarkable fixatives. Frequently it is obtained from storax by extraction after this substance has been hydrolysed with an equal weight of 10 per cent caustic soda solution.

This is the better and finer product. B.P., 258° C. Cinnamic alcohol is also known as **Styrone**, and the principal attribute of this beautiful organic body is that its mild odour when blended with almost any compound adds to its sweetness and persistence. As the base of a mild but persistent hyacinth compound it may be used thus :—

100	Phenylacetaldehyde.
300	Cinnamic alcohol.
250	Phenylethyl alcohol.
100	Heliotropin.
10	Eugenol.
20	Alpha ionone.
60	Benzyl acetate.
20	Jasmin absolute.
40	Ylang-ylang.
100	Terpineol.
<hr/>	
1000	

Cinnamic Aldehyde, $C_6H_5 \cdot CH : CH \cdot CHO$, is prepared synthetically or may be separated from cinnamon or cassia oils by means of sodium bisulphite. It also occurs naturally in the oils of patchouli, myrrh, and *Melaleuca bracteata*. Compared with cinnamon oil it is a liquid with rather a crude odour, but finds a place in soap perfumery as the basis of cheap brown windsors, etc. S.G., 1.055; B.P., 253° C. The specially purified product may be used in tuberosc compounds.

Cinnamon Leaf Oil is distilled from the leaves of *Cinnamomum zeylanicum*, Breyn, N.O. Lauracæ, in Ceylon, South Kanara, and possibly other islands of the East Indies. In Ceylon the leaves are macerated in sea water before distillation, but in South Kanara this part of the process is omitted. Here very crude apparatus is used by the natives, who recognise four varieties of trees by the taste of the leaves, viz. sweet, insipid, pungent, and bitter. For the production of oil they use the last two only. Cinnamon leaf oil is a bright yellow liquid having an odour recalling both cinnamon and cloves. It consists largely of eugenol with traces of safrole and benzaldehyde and is used as

a soap perfume. The **Root Bark Oil** is not often used but is obtainable. It consists principally of camphor.

Cinnamon Oil is distilled principally from the bark of *Cinnamomum zeylanicum*, Breyn, a small (occasionally as high as 40 feet) evergreen tree of the N.O. Lauraceæ, native of Ceylon and cultivated there and from *C. Burmanni* grown in other islands of the East Indies. Cinnamon has been a much-esteemed spice since remote antiquity and is mentioned by many ancient writers. It is also referred to in the Bible. In Ceylon the cultivation of cinnamon is centred in a strip of land about a dozen miles wide on the south-west side of the island, between Negumbo, Colombo, and Matura. It thrives at an altitude of 1500 feet. According to Cayla¹ it is cultivated best in sites protected from the wind and in the shade of *Erythrina*; the tree is propagated from cuttings, runners or seed. Well-grown trees flower in May and fruit in July. If this is not immediately collected it is eaten by birds. Where the soil is fertile the first crop of bark can be gathered during the rainy season at the end of the second year. It is collected by cutting a circle round the trunk, drawing vertical incisions downwards, and stripping. The stripped tree dies, but from the stump, from four to seven shoots grow up, so that a fresh crop can be gathered every two years. The stripped bark is dried by exposure for twenty-four hours and is then scraped to remove the cortex and epidermis. The quills are then packed inside one another to give greater stability in transit, and on arriving in London are unpacked and sorted into firsts, seconds, and so on. The trimmings and broken chips are distilled on the island, some being exported and distilled in Europe. As is well known several other species of *Cinnamomum* exist, the more important being *C. Cassia*, Blume, and *C. Loureirii*, Nees. The former yields the cassia oil of commerce (*which see*) and the latter, which has long been grown in Annam, furnishes the cinnamon used in Japan.

¹ "Journ. d'Agriculture tropicale," 9 (1909), 164: Schimmel's "Report," October (1909), 38.

A comprehensive and up-to-date account of the numerous cinnamon oils recently appeared in the Bulletin of the Imperial Institute.¹ Genuine cinnamon bark yields from about 0.5 to 1.0 per cent of a pale to dark yellow oil having the delicate odour and taste of the bark. It varies as do its properties, according to the place and method of distillation. This question has been very fully discussed by Umney and Bennett² in collaboration with T. Brewis. They were able to show that although English distilled oils often possess a more delicate odour, they generally exhibit a lower specific gravity and contain less aldehyde than imported oils. Cinnamon bark oil consists chiefly of cinnamic aldehyde which by the bisulphite method should be equivalent to about 70 per cent. The characteristic odour is probably due, however, to the modifying influence of eugenol (4 to 10 per cent), a higher aliphatic aldehyde and phellandrene. It is subjected to adulteration with artificial cinnamic aldehyde, cassia oil, and cinnamon leaf oil. Cinnamon bark oil is widely used for medicinal purposes, as a flavour in dental preparations and aromatic cachous, in small quantities in certain types of carnation and Eastern bouquets. The powdered bark is a common constituent of fumigating preparation. Artificial cinnamon oil contains, in addition to the above-mentioned substances, amyl-methyl ketone, cuminic aldehyde, phenyl propyl aldehyde, benzaldehyde, linalol, and methyl eugenol.

Cinnamyl Acetate, $C_6H_5 \cdot CH : CH \cdot CH_2 \cdot OOC \cdot CH_3$, is a semi-viscous liquid having a soft, sweet, woody odour of rose-vetivert type. It blends very well with vetivert, coumarin, santal and ambrette musk, and a base prepared on these lines has great persistent qualities. With geranium it gives beautiful shades of rose odour. Cinnamyl acetate has been shown by Dodge to occur in cassia oil. S.G., 1.050; B.P., 262° C.

¹ 1921, 19, 323 (*see also* "Les Parfums de France," 1923, No. 8, 239).

² "Year Book of Pharmacy" (1910), 376.

Cinnamyl Benzoate, $C_6H_5 \cdot CH : CH \cdot CH_2 \cdot OOC \cdot C_6H_5$, is a liquid having an odour of balsamic character. It is an excellent fixative.

Cinnamyl Butyrate, $C_6H_5 \cdot CH : CH \cdot CH_2 \cdot OOC \cdot C_3H_7$, is a liquid prepared synthetically and so far does not appear to have been found in nature. It possesses a soft fruity odour note which has recently found for it some application in floral perfumery. Mere traces added to odours of the rose-lily type will modify them so that they are only copied with much difficulty. Cinnamyl butyrate will blend well with hydroxy-citronellal, cananga, and linaloe oils. S.G., 1.020.

Cinnamyl Cinnamate, $C_6H_5 \cdot CH : CH \cdot CH_2 \cdot OOC \cdot CH : CH \cdot C_6H_5$, is a crystalline substance, when pure, melting at $44^\circ C$. It occurs in storax, Peru balsam, and melaleuca oil, has a sweet balsamic odour, and is useful in the heavy type of perfume. It is known also as **Styracin**.

Cinnamyl Eugenol is a crystalline substance melting at 90 to $91^\circ C$. When pure it is odourless and will make a useful fixative.

Cinnamyl Formate, $C_6H_5 \cdot CH : CH \cdot CH_2 \cdot OOC \cdot H$, is a liquid, having a sweet balsamic odour. It is employed as a modifier in the vetivert-santal type of perfume.

Cinnamylidene Methyl Carbinol, $C_6H_5 \cdot CH : CH \cdot CH : C(OH) \cdot CH_3$, is an oil having a warm balsamic odour and may be employed in lilac and narcissus compounds.

Cinnamyl Iso-Butyrate, $C_6H_5 \cdot CH : CH \cdot CH_2 \cdot OOC \cdot CH \cdot (CH_3)_2$, is a liquid having a finer odour than the normal butyrate. Its uses are similar. S.G., 1.0164; B.P., $127^\circ C$. at 5 mm.

Cinnamyl Propionate, $C_6H_5 \cdot CH : CH \cdot CH_2 \cdot OOC \cdot C_2H_5$, is a liquid having a fragrant odour reminiscent of grapes and is used in the manufacture of artificial fruit essences. Employed also in narcissus compounds.

Cinnamyl Valerianate, $C_6H_5 \cdot CH : CH \cdot CH_2OOC \cdot C_4H_9$, is a liquid of heavy fruity odour used as a modifier in tea-rose compounds.

Cire—*see* Honey Compounds.

Cistus—*see* Labdanum.

Citral, $C_9H_{16} \cdot CHO$, is an unsaturated branched-chain aldehyde isomeric with **Neral**. It is widely distributed in nature, and among the oils containing it are lemon, lime, mandarin, verbena, lemon-grass, and *Backhousia citriodora*. Citral may be prepared synthetically by the oxidation of geraniol, but commercially it is separated from the two last-named oils. It is very largely used in the manufacture of **Ionone**, and is of value for giving a fresh lemon odour to perfumes. In soap perfumery it is useful for imparting a peculiar note to odours of the rose type. Citral prepared from lemon or lime oils is, however, most esteemed for high-class perfumery, and about 0.1 per cent added to rose compounds will impart a most delightful freshness. The difference in the odour of citral from lemon oils and from lemon-grass oils is most marked, and this had been attributed to a difference in the ratio of citral α to citral β , which in lemon-grass oil occurs as 85-90 per cent of the former and 10-15 per cent of the latter. These two aldehydes correspond with geraniol and nerol, but recently Verley has shown¹ that the citral from lemon oil corresponds with the iso-geraniol of Semmler. Lemon citral is now known as citral γ . S.G., 0.895; B.P., 228° C.

Citronellal, $C_9H_{17} \cdot CHO$, does not find a place in high-class perfumery, but is used for perfuming cheap soaps of the honey and Cologne type on account of its durability. It may be isolated from the oils of citronella and eucalyptus citriodora by means of sodium bisulphite. S.G., 0.855; B.P., 207° C.

Citronellal Hydrate—*see* Hydroxy Citronellal.

Citronella Oil.—There are two principal varieties of

¹ "American Perfumer" (Nov., 1926).

this oil found in commerce—Java and Ceylon. The former has a finer odour, is generally pure, and is distilled principally from the *maha pangiri* grasses ; an oil of similar quality is produced in Singapore and more recently the grass has been successfully cultivated in Burma, the oil having been obtainable on the London market. The Ceylonese has a cruder odour, is often adulterated, and is distilled principally from *lana batu* grasses.

Java citronella oil is distilled principally from *Cymbopogon nardus*, Rendle (*Andropogon Nardus*, L.), N.O. Graminaceæ, and is known also as “winter’s grass,” old citronella grass, and *maha pangiri*. This grass not only differs from that grown in Ceylon in odour, flower, and leaf but also, according to Jowitt¹ in the peculiarity that the roots of *maha pangiri* are more on the surface while *lena batu* is more deeply rooted. The propagation of the plants in Java is by dividing the well-grown, uncut tufts and planting the slips obtained therefrom in rows about 2 to 3 feet apart. This work is undertaken in the wet weather so that the shoots may more easily take root. The best results are achieved when the grass is grown on hillsides facing the sun, but it is sometimes cultivated in rubber plantations. When the plants have become well established, growth is very rapid, and they soon attain a height of 3 feet (about six to eight months). The first crop is cut in about six months and thereafter at four monthly periods. Regularity in cutting is essential otherwise the plants run to seed, and then the growth becomes too dense for satisfactory working. Excellent crops are obtained for the first four or five years, but the grass becomes exhausted after ten to fifteen years. There are approximately 15,000 acres under cultivation in Java, and the average yield per acre is 50 to 60 lb. of oil per annum. In 1902 there were two factories only distilling citronella oil whereas now there are over sixty. They are of modern construction, situated at the bases of hilly ridges to ensure a plentiful supply of water for condensation. Direct-steam

¹ Schimmel’s “Report” (October, 1909), 43.

distillation is employed, and the grass is worked up after having been dried for three or four days. This is done because (1) the bulk is reduced and larger quantities are distilled at each charge. (2) A lower moisture content means a saving of fuel. (3) Oil distilled from dry grass is more easily separated from water of distillation. The geraniol content of the oil varies between 80 and 90 per cent, whereas that of the Ceylonese lies between 60 and 65 per cent only. In addition to the constituents indicated below, Schimmel & Co. have shown¹ that citral occurs in the Javanese oil.

Ceylon citronella oil is distilled principally from *Andropogon nardus*, L., N.O. Graminaceæ, called by Stapf *lena batu* grasses. This grass, however, is stated² to being gradually replaced by *Maha Pangiri*, since it is much more easily grown. The principal centres of the industry are Matara and Hambantota, although formerly Galle was of considerable importance. There is an estimated total of upwards of 40,000 acres under cultivation in the island, and for the production of the oil between four and five hundred stills are used. The distribution of the crop is roughly as follows:—

Matara district	21,000 acres.
Tangalle district	11,880 „

According to N. Wickremaratne³ the seedlings are planted out at distances of from 1 to 2 feet and after eight months the grass is ripe for cutting, after which a crop can be obtained every three or four months up to ten or fifteen years. The work is undertaken by women, who use sickles. The cut grass is left in the sun for a few days to dry and then removed to the distilleries. If distillation is not undertaken at once there is the risk of fermentation, which results in a loss of oil. Modern stills of capacities varying from 700 to 2000 lb. of grass are employed. The direct-steam process is worked. The water-cooled condensers are of the usual worm pattern varying from

¹ "Report" (April, 1910), 37.

² Schimmel's "Report," 1925, 19.

³ "The Tropical Agriculturist," through "C. & D.," 79 (1911), 443.

30 to 60 feet in length. Each distillation takes about six hours and two charges are worked up daily, the exhausted grass being used as fuel for the boilers. The oil, after separation, is removed in the usual way with a cup and filtered several times before transference to tins for export. The estimated yield per acre per annum (four crops) is about eight tons, producing, when the grass is in good condition, approximately 68 lb. of oil. The following bodies have been identified as constituents: Citronellal, camphene, dipentene, methyl heptenone, borneol, geraniol, methyl eugenol, esters of valeric acid, *l*-limonene, a body related to linalol, an alcohol resembling thujyl alcohol, esters of *d*-citronellol, nerol and geranyl acetate. F. Elze has more recently shown the presence of farnesol.¹

The adulteration of Ceylon citronella oil with petroleum is notorious, and the test introduced by Schimmel & Co. has led to much discussion. This consists of the solubility, under certain conditions, of the oil in 80 per cent alcohol, and was intended to restrict the quantity of petroleum that could be added. The value of this test has become reduced since the natives have utilised other more soluble adulterants. In Malay, citronella grass is frequently planted on hilly land as a preventive against soil wash. Citronella oils are very largely used as the raw material for the working up of *citronellal* and second quality *geraniol*. They are also much employed in the soap industry as the basis of cheap perfumes of the curd and castile type. Such compounds are made on the following lines:—

250	Citronella oil.
150	Bergamot oil.
50	Benzaldehyde.
250	Terpineol.
50	Caraway oil.
200	Palmarosa oil.
50	Musk xylene.
<u>1000</u>	

¹ "Chem. Ztg.," 37 (1913), 1422, through the "Report" of Schimmel & Co., April (1914), 46.

Citronellol, $C_9H_{17} \cdot CH_2OH$, is a colourless liquid, isomeric, with rhodinol and occurring in rose, pelargonium, palmarosa, melissa, citronella, and Spanish verbena oils. It has a sweet, rose-like odour and may be artificially prepared by reducing citronellal obtained from Java citronella oil. This alcohol can be used for sweetening almost any perfume, particularly those of rose-lily type.

Citronellol, either alone or mixed with geraniol, is known as **Roseol**, **Reuniol**, etc. There are several derivatives of citronellol. The rose odour is intensified by the introduction of the methyl, ethyl, and phenyl groups into the alcohol-molecule. It is reduced by the introduction of the propyl and butyl groups. Methyl and ethyl citronellol have a perfume reminiscent of tea roses. S.G., 0.870; B.P., 224° C. Quite recently the firm of Givaudan have synthesised *l*-citronellol, identical with the citronellol present in rose otto. It is a beautifully rosy product and, in spite of its high price, is well worth the attention of perfumers.

Citronellyl Acetate, $C_9H_{17} \cdot CH_2 \cdot OOC \cdot CH_3$, is a colourless mobile liquid with an odour resembling a mixture of lime and bergamot oils. It is used in special types of rose and carnation compounds, where it should not exceed 10 per cent, and also for sweetening almost any type of perfume. It occurs naturally in Ceylon citronella oil and probably also in the leaves of *Piper volkensii*. S.G., 0.900; B.P., 119° C. at 15 mm. Citronellyl monochlor acetate has a sharp odour of similar type and is useful in lilac and lily compounds.

Citronellyl Benzoate, $C_9H_{17} \cdot CH_2 \cdot OOC \cdot C_6H_5$, is an oily liquid having an odour of dried rose petals. It is an excellent fixative in all rose compounds.

Citronellyl Butyrate, $C_9H_{17} \cdot CH_2 \cdot OOC \cdot C_3H_7$, is a colourless oil, and when used in small quantities with oak-moss resin will impart to a basic rose oil the odour of moss roses. It occurs naturally in Ceylon citronella oil. S.G., 0.890.

Citronellyl Capronate (Hexylate), $C_9H_{17} \cdot CH_2 \cdot OOC \cdot (CH_2)_4 \cdot CH_3$, is a liquid having a fine rose odour. S.G., 0.861; B.P., 160° at 6 mm.

Citronellyl Cinnamate, $C_9H_{17} \cdot CH_2 \cdot OOC \cdot CH : CH \cdot C_6H_5$, is an oil of fragrant odour. Useful in certain types of rose compounds. S.G., 0.985.

Citronellyl Formate, $C_9H_{17} \cdot CH_2 \cdot OOC \cdot H$, has a bergamot-cucumber-rose odour. It is a colourless to pale yellow liquid, and is useful in special types of rose perfumes. With a suitable backing of ylang-ylang and hydroxy citronellal, this ester forms an excellent base for artificial muguet. S.G., 0.910; B.P., 100° C. at 10 mm.

Citronellyl Iso-Butyrate, $C_9H_{17} \cdot CH_2 \cdot OOC \cdot CH \cdot (CH_3)_2$, is an oil having similar properties to those of the normal butyrate. S.G., 0.883; B.P., 130° C. at 5 mm.

Citronellyl Propionate, $C_9H_{17} \cdot CH_2 \cdot OOC \cdot C_2H_5$, is a liquid of fruity rose odour. It is used as a modifier in all such perfumes. S.G., 0.8950. This ester is also valuable in honeysuckle compounds.

Citronellyl Valerianate, $C_9H_{17} \cdot CH_2 \cdot OOC \cdot (CH_2)_3 \cdot CH_3$, is a liquid of peculiar rosaceous bouquet. It is used to some extent as a blender in perfumes, but more frequently as a flavour for tobaccos. S.G., 0.883; B.P., 195° C. at 31 mm.

Civet is a soft, fatty substance of animal origin. It is imported principally from Abyssinia, and arrives in the London market in horns containing between 24 and 30 oz. When fresh it is yellowish-white in colour, but on exposure to the air this becomes darker and the mass assumes a harder consistence. The odour is disgustingly obnoxious, but like many odours of animal origin it becomes very pleasant and attractive on extreme dilution.

Civet is a glandular secretion appearing in an outwardly discharging pocket (two sacs) underneath the posterior appendage of both male and female civet cat—*Viverra*

civetta, a native of Abyssinia, Guinea, and Senegal. The secretion also appears in other species of civet cat, of which the following are of interest:—

Viverra Zibetha, found in the Indian Archipelago.

V. rasse, found in Java.

V. tangalunga, found in Bengal, Borneo, and Sumatra.

It has not yet been shown what part the secretion plays in the life of the animal. It may function as a sexual attraction, or on the contrary as a weapon of defence from attack by other animals.

Although the civet cats are found throughout Equatorial Africa from Guinea and Senegal to Abyssinia, the latter is the chief centre of its industrial exploitation, and more particularly, according to M. Tribaud,¹ the provinces of Wollega, Djimma, Kaffa, and Limou. The animals are about the size of a fox, with a grey fur and black spots. They are not specially bred. The natives capture the cats and confine them in wood and wire cages. Since the quantity and quality of the secretion depends largely upon their food, they are fed on fresh meat—preferably mutton. A dozen civet cats are said to consume one sheep in about three days. The native civet traders usually have about 30 cats as the source of their wares, and since heat increases the yield, several cages are kept in specially heated huts. When the secretion is collected, the animal is held firmly in its cage which is opened underneath and the contents of the pouch removed with a small ivory or bamboo spoon. This operation is repeated several times a week, and an average animal will yield up to 4 grams in this period. Although both sexes secrete civet, that from the male is superior in both quantity and quality. Teasing increases the yield. The collected civet is packed in zebu horns and sent to Addis Ababa, various dues being paid on the route. On exportation, a tax of 15 per cent is also levied. Owing to its reputed aphrodisiac properties, a certain quantity of

¹ "Manufacturing Chemist," May and June, 1934.



Fig. 8. -The Civet Cat.

[*Les Parfums de France.*

[*To face page 126.*



[C.A.P.P.]

[To face page 127.]

FIG. 9. --Collecting Civet and showing the secreting organ.

civet is consumed locally. The Arab women are said to use it also for beautifying the hair and eyebrows.

The characteristic odour of civet is due to the presence of a ketone called *zibetone* which has been isolated by E. Sack.¹ The relationship between this ketone and muskone has been demonstrated by Ruzicka and is referred to elsewhere.

Civet is liable to adulteration with yellow paraffin jelly, mucilage of gum acacia, honey, beeswax, lanolin, banana pulp, coco-nut fat, and butter. The commercial evaluation of this raw material is dealt with in detail by Bennett and Seaber in a well-known perfumery paper.²

Civet has long been employed as a perfume and one of its earliest uses was in the perfuming of gloves by Italians and Spaniards. It is used to-day almost exclusively as a fixative and may be extracted as described in the Chapter on Fixation (Volume II.). It is frequently employed in the form of a strong tincture (about 3 per cent) when it is rubbed down in a mortar with an equal weight of powdered orris root or clean sand and macerated with strong alcohol for one month. For use the tincture is filtered bright in a cold atmosphere. More recently the Grasse houses have put on the market *absolute* civet. This is prepared by extracting the animal product with a volatile solvent, filtering out the insoluble matter, removing the dissolved fats by freezing and concentrating the resultant solution *in vacuo*. It occurs as a black or deep brown viscous liquid having the typical odour familiar to all perfumers. For use it is merely diluted with alcohol or an odourless solvent. It is a very convenient method of handling this otherwise objectionable product.

Civet Synthetic.—Many artificial substitutes are offered, and are merely mixtures of indole, skatole, phenylacetic acid, etc., but they will never entirely replace the natural product,

¹ For details of the process consult "Chem. Ztg.," 39 (1915), 538, or "Report" of Schimmel & Co., October (1915), 51.

² "P. and E.O.R." (1929), 14.

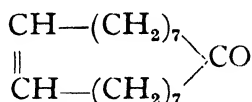
as they lack the characteristic softness of odour on dilution. Such imitations may be prepared on the following lines :—

50	Indole.
100	Skatole.
200	Tetrahydro- <i>p</i> -methyl quinoline.
350	Phenylacetic acid.
300	Musk xylene.
<u>1000</u>	

Mix, melt together, crystallise and powder.

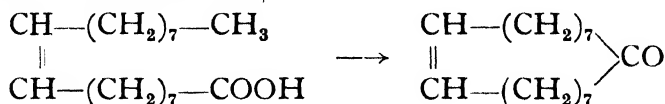
Civettal—see Tetrahydro-*p*-methyl Quinoline.

Civettone is the highly odorous ketone present in natural civet and first isolated by E. Sack. The relationship existing between it and muskone was first brought to light by M. L. Ruzicka in 1925, and its constitution was demonstrated by this chemist in a Swiss journal¹ in 1926. The formula for civettone is



and its commercial synthesis by Naef is now an accomplished matter.

It is a white crystalline substance, readily soluble in alcohol, and is employed in fine perfumery in exactly the same manner as civet. It possesses the advantage of a clean odour and in high-class scents is much esteemed. Biologically civettone may be attributed to the transformation of oleic acid, thus :—



A complete account of its synthesis appears in a booklet issued by the well-known house of Naef.

Clary Sage Concrete is obtained from the flowering tops and frequently from the whole plant, by means of

¹ "Helvetica Chemica Acta," 9, 230.

volatile solvents. It is green in colour, insoluble in alcohol owing to the presence of waxes, etc., and possesses an odour resembling ambergris but quite different from that of the volatile oil referred to below. The yield is about 0.5 per cent, and owing to its comparatively low cost, is useful in soap, being incorporated during the milling process. Some firms now offer concrete clary sage which is soluble on warming with other oils.

Clary Sage Oil is obtained by distillation from the inflorescences, and more frequently the whole herb of *Salvia Sclarea*, L., a xerophilous plant of the N.O. Labiatae, native of Southern France, Italy, and Northern Africa.¹ It is stated to have been introduced into English cultivation in the year 1562, and was for some time a popular medicine, being mostly employed in disordered states of digestion. The name "clary" comes from the Latin *Sclarea*, a word derived from *clarus*, clear. This was often popularly modified into "clear-eye" from the fact that a decoction of the seeds placed in the eye would "clear" it of any foreign body. On this account it was even called "see bright" and "eye bright." The herb was first employed commercially by the wine merchants of Germany, who infused it with elder flowers, and then added this liquid to the Rhenish wines, which were thereby converted into "muscatels." The plant is still known in Germany as *Muskateller sallier* (muscatel sage) and is now acclimatised there and also in Holland. Clary sage has been cultivated in the Piedmont district of Italy since 1908, the powdered flowers being used in the manufacture of various brands of vermouth, associated with the town of Turin, to which they impart the peculiar flavour resembling that of muscatel raisins. It is this aroma which is so distinctive in fine quality essential oils, such as certain varieties of geranium and neroli, and which is absent in synthetic

¹ According to Cavara ("Profumi Italici," 2 (1924), 29) *Salvia Spinosa*, L., occurs in Italian North Africa and in both appearance and odour closely resembles clary sage.

aromatic chemicals, as instanced by geraniol and nerol (in comparison). Messrs. Schimmel & Co. cultivated the plant experimentally in their gardens at Miltitz at least as early as 1905, and in their November "Report" of that year, page 62, recorded a yield of 0.117 per cent of a bright olive-green oil with a peculiar odour. This essential oil evidently attracted the attention of perfumers and was examined by Messrs. Roure-Bertrand Fils in 1908.¹ It is to M. Gattefossé that we are indebted for the introduction on a commercial scale of this valuable plant as a perfume. In 1909, in collaboration with M. Mus, he undertook the cultivation of clary sage in the department of Vaucluse in France, and in the first year the essential oil obtained from the herb was made use of by a few of the leading Parisian perfumers. More recently M. Gattefossé has experimented widely in the cultivation of clary sage, and he states² that the methods employed in growing and gathering the plant appear to materially influence the physical character of the essential oil obtained. The use of manure, generally known as increasing the quantity of the flowers (at the expense of the leaves), is important and favourable. The maturity of the seeds, the hour of collection, and the more or less dry state of the plant, make the principal characters vary between very wide limits. They are cultivated *without irrigation*, principally under the olives and on stony hills. The author was able to cultivate a good crop of clary sage in his garden at Epsom in 1925, and more recently his friend, C. Farmiloe, had a good crop at Purley Park, Reading. In both cases the odour of the inflorescence and the herb was of a decidedly musky-amber character.

In recent years clary sage has been grown from seed in England, the distilled oil comparing favourably with the finest French products. This work was first undertaken by Mr. Linn Chilvers on his Flower Farms at Heacham, Norfolk, and distilled by the author for Messrs. Yardley in their plant at Fring. Subsequently, Messrs. Stafford Allen

¹ "Bulletin," April (1908), 10.

² "La Parfumerie Moderne" (1922), 59.



[W.A.P.]

FIG. 10.—English Clary Sage growing at Heacham.

[To face page 130.]

& Sons grew clary at Long Melford, and their oil is a much appreciated commercial product.

With the object of fixing the best time for distilling clary sage, A. Chiris¹ has shown that the weight of herb gathered from a given area of cultivation seems to attain the maximum at the commencement of the flowering period ; it then decreases rapidly up to the moment when the seeds are completely formed. The content of the plant in essential oil increases *pari passu* with the fall of the blossoms until the seeds have reached maturity. It is also during this somewhat brief period that it is possible to obtain the maximum quantity of oil per hectare. The yield reaches 0.12 to 0.15 per cent. The distillation of the stalks and leaves gives a small quantity of oil, but this seems to contain, to a higher degree than oil from the entire plant, the musky smell peculiar to clary sage.

A. Chiris observed in this plant the same phenomenon as in lavender ; the flowers distilled alone give an oil richer in ethers than does that from the entire plant taken from the same lot and distilled on the same day. The flowery tips represent about one half the weight of the entire plant and the stalks and leaves yield very little oil ; the entire plant ought therefore to give an oil practically as rich in ethers as the tips, the total yield only being lower. In view of the fact that the contrary was observed, it is to be supposed that, during distillation, the stalks and leaves have a destructive effect on the ethers, and that there is a certain advantage in distilling the tips alone or at least separately.

According to the figures published by A. Chiris the average yields were as follows :—

Oil from flowering tips	.	.	.	.	1.09
Oil from entire plants	.	.	.	.	0.74

That the yield of oil from clary sage plants is subject to wide fluctuation has been shown by Dr. E. S. Guenther,²

¹ "Les Parfums de France" (1929), 149.

² "American Perfumer," Oct. (1932), 425.

who in the course of practical experiments in the South of France obtained one pound of oil from 1400 pounds of herb at Pegomas, and from 680 pounds at Barreme. From plants of the same origin he obtained at Seillons (Var.) one pound of oil from 1050 pounds of herb in 1930 and from 700 pounds in 1931.

Clary sage oil possesses an odour of fine fragrance, recalling a mixture of ambergris, musk, neroli, and lavender. It contains linalol and linalyl acetate, but the chemistry of the oil is at present incomplete. It is an indispensable constituent of ambers, chypre, carnation, trèfle, foin coupé, and orchidée, while most artificial perfumes are much improved when a small quantity is added to them. It materially assists in suppressing their harshness, but at least a month must elapse before this becomes evident. Perhaps the most valuable application of genuine clary sage oil, however, is in eau-de-Cologne, to which it imparts a mellowness, sweetness, and persistence which is unobtainable even with ambergris. The composition of this product is related to bergamot oil by reason of its high linalyl acetate content, and to lavender by its odour of muscatel, which makes its use imperative in the finest eau-de-Cologne and lavender waters. Further, it is the only product capable of improving the odour of artificial musk, and in this connection it is interesting to note that M. Gattefossé succeeded in producing a hybrid, to which the name of *Salvia turquestiana* has been given, and which was grown in the plantations at Fontescalières, near Nîmes. Although this variety yielded less essential oil, its perfume had a slightly higher musk odour. The high price of the oil of clary sage is explained by the fact that the yield is only about 0.1 per cent. A slight disadvantage in its use is its low solubility in alcohol. An example of the use of this oil in artificial amber will be found under cypress oil. Owing to its comparatively high cost, clary sage oil is subject to adulteration. Linalol, linalyl acetate, and propionate or mixtures thereof are more commonly employed. Naturally the odour of the oil suffers and particularly its strength.

The water which distills over with the oil is now made use of commercially. It is used in wines, makes an excellent diluent for liquid dentifrices containing peppermint, and with terpeneless oils is capable of producing economically Colognes of soft musky fragrance. These may be prepared as follows :—

Alcohol, 95 per cent	. . . . .	600 c.c.
Clary sage water	. . . . .	400 "
Terpeneless Cologne compound, ¹	q.s. to produce	
a clear solution.		

Clary Sage Absolute is a substance having the consistence of hard honey and of a greyish or greenish-yellow colour. It is extracted in the usual manner by means of volatile solvents and is soluble in the principal organic solvents and essential oils. It is characterised by a very fine subtle and lasting fragrance. Its most beautiful application is possibly in chypres and semi-heavy toilet waters. The absolute has recently been examined by Volmar and Jermstad² who found it contained no phenols, aldehydes, ketones or nitrogen compounds ; beyond a small amount of free acids it only contained hydrocarbons, alcohols, and esters ; it is chiefly distinguished by a considerable proportion of a crystalline substance embedded in a viscous mass. The chief constituents are free acetic acid and traces of free unsaturated acid, linalol and linalyl acetate, a substance similar to cedrene, sclareol (crystalline), and a sesquiterpene alcohol.

Clerodendrons are mainly tropical in their habit. *C. trichotomum* is a Japanese plant and is grown to a limited extent in this country. It attains a height of about 5 feet and bears large loose clusters of white flowers having a sweet honeysuckle-verbena fragrance. In the after smell there is a distinct odour recalling jasmin rich in indole. An artificial perfume would be based on hydroxy citronellal,

¹ For these consult Volume II.

² "P. and E.O.R." (1928), 143 (*see also* "Parf. Moderne" (1927), 151).

ionone, and ylang-ylang, the floral note being imparted with jasmin and tuberose.

Clove Oil is obtained by distillation of the dried unexpanded flower buds of *Eugenia caryophyllata*, Thunberg, N.O. Myrtaceæ, a beautiful evergreen tree, native of the Molucca Islands but now extensively cultivated in Zanzibar, and Pemba, and also to a large extent in Amboyna, Madagascar, Penang, etc. The exports of cloves during 1924 from the two main producing countries were as follows :—

Zanzibar	.	.	.	.	.	8465 tons
Madagascar	.	.	.	.	.	562 „

Cloves were known in China as early as 266 B.C., when it was customary for the officers of the Court to hold the spice in the mouth before addressing the Sovereign in order that their breath might have an agreeable odour. They were known to Pliny, but are not mentioned by Theophrastus ; it seems doubtful, however, if the former's description actually referred to the spice. The Molucca Islands were discovered at the beginning of the sixteenth century, but soon passed from the hands of the Portuguese into those of the Dutch. Efforts were made by the latter to monopolise the trade in cloves, but the French successfully introduced the tree into Réunion and Mauritius. In the year 1808 the Arabs brought the first cloves to Pemba and Zanzibar, but it was a considerable time before the Sultanate recognised that these areas were especially suitable for the culture of the spice. Slaves were largely employed in the industry, but in 1871 slavery was partially abolished which naturally increased the cost of production. A typhoon swept over Zanzibar in the same year and destroyed the plantations, but Pemba escaped and at once took advantage of the shortage and increased prices. New plantations were immediately laid down in Zanzibar, and although the crops were good in 1895 the troubles at the end of the nineteenth century retarded their progress. The clove tree flourishes best in

a red or brown clay soil. Before sowing the seeds are softened in water for three days, and after germination are planted in shaded beds. They are roofed over for about twelve months, after which period the roofing is gradually removed until the young seedling has been exposed to the sun for two or three months. They are then transplanted about 20 feet apart. The tree attains an age of about ninety years and grows to a height of 40 to 50 feet. According to information supplied by the exhibitors at the British Empire Exhibition, Wembley, there are now some 40,000 acres under cultivation in Zanzibar. These have an estimated stock of about 4,000,000 trees yielding from 3000 to 14,000 tons of cloves annually (average about 8000 tons). Individual trees have been known to produce 75 pounds of dry cloves, but the average yield from large plantations under efficient management may be taken at 8 to 10 pounds per tree per annum—equal to 800 to 1000 pounds of dry cloves per acre. The seasonable harvest takes place from July to February with a break during October and November. The cloves are picked as soon as they turn pink and before the buds have burst. The harvest is collected by men, women, and children who spend most of the day in the tree tops. The bunches of cloves are picked by hand and dropped into a cloth which is tied round their necks. These are brought to the drying ground, where the buds are broken away from the stems and spread out on mats in the sun to dry. **Mother of Clove**, *anthophylli*, is the mature seed and being of less value is often used as an adulterant. Since it contains *starch* which is absent in ordinary cloves, it can be easily detected. Immature cloves are also added to bad samples which are known to the trade as "Koko." On January 1st, 1926, a decree came into operation in Zanzibar to prevent the adulteration of cloves, particulars of which may be found elsewhere.¹ The degree of moisture now allowed is indicated by the breaking of the clove when slowly bent. The cloves from Zanzibar are sent principally

¹ "P. and E.O.R." (1926), 4.

to Bombay and the East, although large quantities are distilled in Europe, while those from Pemba, which constitute about three-fifths of the whole, find their way to the distillers in Europe. Penang and Amboyna cloves are larger and brighter in colour than the above, and the oil distilled from the Amboyna variety is considered by far the finest for perfumery purposes. Madagascar clove oil has recently come into more prominence on the continent, and is used there as the main raw material in the synthesis of vanillin. Some perfumers are of the opinion that the re-distilled oil has a finer odour. This is supposed to be accounted for by the fact that Madagascar cloves are drier than the others and in consequence more aromatic.¹ An account of the production of this raw material, by V. H. Kirkham, will be found elsewhere.² **Royal Cloves** from *caryophyllum regium* were at one time much prized on account of their rarity and the extraordinary stories told of them. According to Pomet,³ the tree which bears them is the only one in the world and only found in the middle of the Island of Maffia in the East Indies where it is called by the inhabitants of the island *Thinca Radoi*. This fruit, by the order of the king of the island, is guarded by soldiers so that no person may have it but himself. They pretend likewise that when this tree is laden with fruit the other trees bend down towards it, to pay their homage! It is interesting to know that a new market has been found for cloves in Java where the natives mix it with tobacco for smoking purposes.

Clove oil contains upwards of 85 per cent of **Eugenol** which is largely used in the synthesis of **Vanillin**. In addition to the phenol eugenol, the following bodies have been identified: acet-eugenol, methyl - normal - heptyl - alcohol, benzyl alcohol, methyl salicylate, *a*-methyl furfurol, *a*-dimethyl furfurol, furfuralcohol, methyl-normal-amyl-carbinol and the terpene caryophyllene. On account of its

¹ M. Ledreux, "P. and E.O.R." (1929), 238.

² "P. and E.O.R." (1929), 6.

³ "Histoire des Drogues," 1694, p. 125, Book vii.

flavour and disinfectant properties, clove oil is much used in dental preparations such as tooth pastes and mouth washes. It is largely employed in soap perfumery as a sweetening intensifier and blends well with geranium, bergamot, caraway, and cassia oils. The Amboyna oil is blended with eugenol and iso-eugenol as the basis of some of the finest carnation compounds.

Clove Root Oil is obtained by distillation from the roots of the clove tree cultivated in Zanzibar and Pemba. When freshly distilled the oil is bright yellow in colour and the yield averages about 6 per cent. The composition, odour, and quality of this oil compares favourably with that obtained from the buds (*see above*).

Clover—*see* Trèfle in Volume II.

Cochineal is the dried fecundated female insect, *Coccus Cacti*, Linné, reared on different species of *Nopalea* (Cactaceæ) in Mexico, the West Indies, and Canary Islands. The bulk of the commercial article to-day comes from the latter place. The two most important varieties in commerce are silver grain and black grain. The former is more commonly met with and its silvery appearance is due to a waxy covering, the insects being killed without heat by means of sulphur fumes. The latter, which are dark brown to black, are killed by boiling water, the wax being removed in the process. Cochineal is often adulterated—the silver grain with barium salts, etc., and the black grain with magnetic iron sand, lead sulphide, etc. As the ash is generally about 3 per cent in a good quality specimen, any ash limit exceeding about 6 per cent should cause the rejection of the sample. **Carminic Acid** (methyl dioxynaphthoquinone) is the colouring matter present and it exists up to about 10 per cent. It may be isolated in the form of tiny red prismatic crystals which are soluble in alkalis, alcohol and water, but insoluble in fixed and volatile oils. “**Granilla**” is an inferior cochineal, probably consisting of the siftings (small insects and *Nopalea* debris). Carmine (*which see*)

is prepared from cochineal by the precipitation of decoctions with alum, etc.

Liquid Cochineals are made by either digesting the insects or carmine with an alkali (ammonia or potash being most commonly used), straining the solution, and making up to the required volume with a mixture of glycerine and water or alcohol. An example of such a preparation will be found under Carmine.

Coco-nut Aldehyde (so-called)—*see* Nonyl Lactone.

Coco-nut Oil is obtained either by expression or by decoction from the fruit of the coco-nut palm, *Cocos nucifera*, and *C. butyracea*, L., N.O. Palmaceæ, and indigenous to all tropical countries. At normal temperatures it is a firm white fat and is readily subject to rancidity. It is much employed in the manufacture of toilet and shaving soaps on account of its abundant lather. Of late years it has become very popular as an "emulsified" shampoo (after saponification with potash), and also as an application to the skin for hastening sun-tan. For further information consult Volume II.

Coffin-wood Oil is distilled from the root stocks of three conifers: *Fokienia Hodginsii*, A. Henry, known as Pe-mow, *Cunninghamia sinensis*, R.Br., known as Se-mou., and from *Dacrydium elatum*, Wall., known as Hoang-da. These trees, attaining a height of 50 feet, are found in the higher regions of Tonkin and Annam, and their wood exhales an agreeable odour of cedar and sandalwood. While quantities are distilled, by far the larger quantity is utilised for the manufacture of jewel boxes and rich coffins—hence the gruesome name. The oil is more commonly known as Bois de Siam.

Cognac Oil is produced during the fermentation of grape juice and is separated by fractionating the residues from the manufacture of brandy. It is used in the pre-

paration of artificial flavouring essences and only occasionally in perfumery where its place is generally taken by ethyl heptoate (*which see*).

Colobot Oil is obtained by steam distillation from the peel of *Citrus hystrix*, D.C. var. *torosa* (Blanco), Webster, spiny trees attaining a height of about 20 feet and belonging to the N.O. Rutaceæ. Their natural habitat is the Philippines where the crushed fruits are used as a shampoo and the crushed rinds are added to coco-nut oil to produce a fragrant brilliantine for the hair. The yield of oil from the fresh fruits is in the region of 2 per cent and the odour reminds of limes. It contains 26 per cent of citronellol, some terpenes and other aldehydes so far unidentified.

Concrete Orris—*see* Orris.

Concretes—*see* under Absolutes, and consult Volume II.

Convallaria Majalis—*see* Lily of the Valley.

Convolvulus Oil—*see* Rosewood Oil.

Copaiba Balsam is the oleo-resinous exudation from the trunk of *Copaifera Lansdorfi*, Desfontaines, and other species¹ of the N.O. Leguminosæ, trees found in the valley of the Amazon and other parts of South America. It occurs in the schizogenous ducts which abound in the trunk of the tree and also in lysigenous cavities which appear to be formed by the cell walls dissolving in, or being metamorphosed into, oleo-resin. The pressure is said to be so great sometimes that the trees burst with a loud bang. The oleo-resin is collected by cutting a large square hole about 2 feet from the ground and well into the wood, a kind of spout made of bark is attached to the lower side. The oleo-resin is discharged into the cavity and runs thence into drums and barrels in which it is

¹ Consult the detailed account by the author in "The American Perfumer," November (1924), 479.

exported. The yield varies, but as much as 12 gallons is said to be sometimes obtained from a large tree. The chemical and physical characteristics differ slightly according to the source, but a large percentage of volatile oil is always present. This contains the terpene caryophyllene. Copaiba oleo-resin has not a wide application in perfumery. It is, however, an excellent fixative for soaps and its fresh, somewhat peppery odour blends well with geranium, cinnamon, clove, and cassia.

Coriander Oil is distilled from the ripe fruits of *Coriandrum sativum*, L., an erect herbaceous annual of the N.O. Umbelliferae, indigenous to the regions bordering on the Mediterranean but now cultivated largely in Russia, Germany, and Northern Africa. It is not much grown in Britain. The cultivation of this plant is most efficient, according to Dafert and Wallentin,¹ if they are placed in rows about 8 inches apart. At this distance and given suitable weather—a cool, rainy spring and a hot, dry summer—the plants are able to develop a vigorous growth and when distilled yield a higher percentage of essential oil. Before the fruit ripens the whole plant possesses an unpleasant odour which subsequently disappears. It is cut and thrashed. The fruits have been used as a spice since the earliest times. Those of German and Russian origin yield about 1 per cent of essential oil which consists principally (up to 90 per cent) of linalol. The following bodies have also been shown to occur in oil of coriander: geraniol and *l*-borneol with their acetic acid esters, *n*-decylic aldehyde, dipentené, terpinene, cymène, and pinene. Phellandrene may also be present. It has a very limited application in fine perfumery being used as a substitute for linalol in exceptional cases where a more flowery first note is desired as in lily. It is also used for special effects in Cologne when traces only are necessary.

Coriandrol is a name given to impure linalol.

¹ "Report" of Schimmel & Co. (1925), 23.

Corn Starch—*see* Maize Starch.

Coronation Oil is the anointing oil used in Westminster Abbey at the Coronation of their Britannic Majesties. Its composition is based upon a formula dating back to the 17th century, and it contains in a base of sesame oil the essential oils of rose, orange blossom, jasmine and cinnamon, together with benzoin, musk, civet and ambergris. It is prepared by the King's Chemists, Messrs. Squire & Sons, Ltd., of Oxford St., London.

Cortinarius Suaveolens is an aromatic fungus discovered by F. Bataille and L. Joachim¹ in the woods of Fontainebleau. It has a strong odour of orange blossom which remains until the fungus is quite dried up. *Compare also* Mushrooms.

Corylopsis perfumes are generally expected to resemble the odour of *Corylopsis spicata*, a plant of Japanese origin, three or four feet high, one of a group of hardy shrubs closely allied to witch hazel. This bears pendulous racemes of yellow cowslip-scented flowers, that appear before the leaves in spring. The perfume is compounded usually on the lines of the lily, ylang-ylang type, to which small quantities of patchouli oil are added. The following formula will make a useful imitation :—

200	Benzyl acetate.
70	Linalol.
80	Cinnamic alcohol.
150	Geraniol—Java.
110	Ylang-ylang—Bourbon.
300	Hydroxy citronellal.
10	Patchouli.
10	Rose absolute.
20	Jasmin absolute.
10	Decyl aldehyde—10 per cent.
40	Musk ketone.

1000

¹ Schimmel & Co., "Report" (1919), 103.

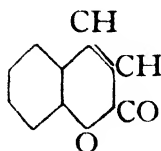
Costus Oil is obtained by distillation of the roots of *Aplotaxis lappa*, Decaisne, a perennial plant of the N.O. Compositæ found growing in North-Western India. The herb is from 5 to 7 feet in height with large radical leaves. There are several flower heads which are bluish-black or quite black in colour. Costus roots have been used as incense from time immemorial by the Chinese ; the plant is mentioned by some of the early writers such as Dioscorides and Pliny, it is also considered by some authorities to be the *Cassia* mentioned in the Bible.¹ The principal centre of production is at a height of about 10,000 feet in the mountains of Kashmir and Sikkim, particularly in the Kishengang valley, from Tilel down to Karnah, and the higher elevations of the Chenab valley. It is also found sporadically in Reasi, Ramban and Udhampur districts in shady moist places, specially under birch trees and dwarf willows. The harvest is in September and October, the roots being dug up when the plants begin to be torpid. They are chopped up and exported without any special preparation (Kashmir Government monopoly). Production appears to be in the region of 500 tons per annum which is sent principally to Bombay and Calcutta, thence to China, Persia, etc. The sale of the roots is a Crown monopoly and very little reaches the English market. Reasonable quantities have latterly reached the Grasse manufacturers who produce an excellent volatile oil as well as an absolute prepared by the usual flower process. Costus is known variously as koot, koost, kosht, kost, kashmirja, kushtha, kuth, kusta, kastam, chob-i-qut, kur, putchuk, goshtam, changala, sepuddy, upalet, ouplate and pachak. It is employed locally by the shawl-merchants to protect the Kashmir fabrics from the attacks of insects. The yield of essential oil is about 1 per cent, but 2.78 per cent has been recorded.² This has been examined by Semmler and Feldstein who have identified the following constituents : camphene, phellandrene, aterpene alcohol, α -costene, β -costene, aplo-

¹ Ps. xlv. 8.

² Schimmel's "Report," October (1913), 47.

taxene, costol dihydrocostolactone, costolactone and costic acid. The oil has a pleasant and persistent violet-like odour, being more agreeable when not too old. It imparts to violet, narcissus, and fougere perfumes a *cachet* which is inimitable. Minute quantities suffice. Elecampane is said to be an adulterant, the roots being used with the costus during distillation.

Coumarin, as met with in commerce, is synthetically prepared by heating together salicylic aldehyde, sodium acetate and acetic anhydride, but was at one time obtained from the leaves of *Liatris odoratissima*, Willd., a herb belonging to the N.O. Compositæ and indigenous to the Southern states of North America. It may be obtained as a powder or small or large crystals, melting at 69° C. and boiling at 291° C. Coumarin occurs naturally in some thirty different plants among which woodruff, sweet-scented vernal grass, liatris, and melilot are of importance. It does not occur, however, until the plants have withered, and appears to result from the splitting up of a glucoside under the influence of an enzyme. This has been the subject of researches by Bourguelot and Herissey.¹ Coumarin also occurs in French lavender and tonka beans. In the latter case, according to Senft,² it does not occur in the pod, but is found in the tissue cells of the cotyledons dissolved in the fatty oil. Coumarin is also present in several species of *orchis*. The lactone, however, does not occur as such, but is the product of glucosidal decomposition. It has the formula



¹ Roure-Bertrand Fils' "Bulletin," October (1920), 101.

² "Apotheker Zeitung," 19 (1904), 271 through Schimmel's "Report," October (1904), 134.

Under the influence of strong light, coumarin in the presence of oxygen is liable to undergo decomposition with the formation of salicylic aldehyde, dihydrodicoumarin and salicylic acid. It possesses an odour recalling new-mown hay, into which type of perfume it largely enters. This lactone is soluble in almost all liquids used in perfumery, and it blends well with vanillin and heliotropin. Coumarin is universally used for imparting strength to numerous types of compounds, such as tobacco and fern, of which latter an example is given :—

100	Lavender.
100	Linalol.
200	Bergamot.
70	Terpinyl iso-butyrate.
100	Geranyl acetate.
30	Bornyl acetate.
20	Patchouli.
50	Oakmoss resin.
80	Benzoin R.
50	Musk ketone.
200	Coumarin.
<u>1000</u>	

It is also a favourite odour base for vanishing creams, and is universally used in soaps. Coumarin from tonka beans may be obtained, but it is liable to adulteration with acetanilide. The methyl and ethyl ethers of coumaric acid do not appear to have any extensive use.

Crab Apple trees are found widely distributed in the northern hemisphere. Those producing the most odorous flowers are *Pyrus coronaria* and *P. augustifolia* species indigenous to North America and bearing large pale pink blossoms. The trees belong to the N.O. Pomaceæ. The perfume is not extracted from the flowers, but may be compounded in the following lines :—

50	Ethyl malate.
10	Amyl acetate.
30	Phenylacetic aldehyde.
50	Anisic aldehyde.
200	Bois de rose oil.
20	Ionone.
80	Benzyl acetate.
100	Ylang-ylang oil.
20	Nutmeg oil.
10	Methyl salicylate.
100	Mimosa absolute.
150	Jasmin absolute.
20	Concrete orris oil.
40	Musk ketone.
60	Coumarin.
60	Heliotropin.
<u>1000</u>	

Cratègeine is a pseudonym for anisic aldehyde.

***p*-Cresol** or para-cresol, $\text{CH}_3 \cdot \text{C}_6\text{H}_4 \cdot \text{OH}$, known also as paramethyl phenol, occurs as a white crystalline substance melting at 33° to 36° C. and boiling about 202° C. It has a phenolic odour of narcissus type, and when especially purified may be used in these flower compounds.

***p*-Cresol Butyl Ether**, $\text{C}_7\text{H}_7 \cdot \text{O} \cdot \text{C}_4\text{H}_9$, is a powerfully odorous liquid of the ylang-ylang type, but having a more flowery note than the *methyl ether*. Its uses are similar.

***p*-Cresol Methyl Ether**, $\text{C}_7\text{H}_7 \cdot \text{O} \cdot \text{CH}_3$, is a colourless mobile liquid with a characteristic odour, which in extreme dilution recalls that of wallflower. S.G., 0.976; B.P., 175° C. It is prepared artificially, but occurs naturally in ylang-ylang and wallflower oils and probably in champaca oil. Its effective use in perfumery requires practice, as an excess will spoil any compound. Its principal use is in preparing synthetic wallflower, hyacinth, narcissus, jonquille, and ylang-ylang oils. It is also used as a soap perfume

in combination with bromstyrole, an example of which is given :—

20	<i>p</i> -Cresol methyl ether.
500	Terpineol.
50	Bromstyrole.
30	Sassafras.
100	Cedarwood.
20	Methyl anthranilate.
250	Palmarosa.
30	Musk xylene.
<u>1000</u>	

This is suitable for perfuming green palm oil soaps, 10 ounces to the hundredweight.

p-Cresol Phenyl Ether—*see* Phenyl Cresyl Oxide.

p-Cresyl Acetate, $\text{CH}_3 \cdot \text{C}_6\text{H}_4 \cdot \text{OOC} \cdot \text{CH}_3$, is a colourless liquid having a very penetrating odour suggestive of urine which in extreme dilution assumes a fragrance reminiscent of narcissus. S.G., 1.0528. It was at one time considered indispensable for the accurate representation of the odour of this flower, but is now often replaced by the phenylacetate (*which see*). *p*-Cresyl acetate is known under the pseudonym **Narceol**. In mere traces it probably occurs naturally in the oils of ylang-ylang and wallflower. An indication of its use in artificial narcissus is appended :—

25	<i>p</i> -Cresyl acetate.
200	Linalol.
300	Terpineol.
150	Petitgrain oil—French.
70	Phenylacetic aldehyde.
30	Rose absolute.
20	Tuberose absolute.
5	Methyl para-cresol.
100	Iso-eugenol.
100	Anisic aldehyde.
<u>1000</u>	

m-Cresyl Cinnamate, $\text{C}_7\text{H}_7 \cdot \text{OOC} \cdot \text{CH} : \text{CH} \cdot \text{C}_6\text{H}_5$, is a white crystalline powder melting at 65°C ., but does

not appear to have found a use in perfumery. Under the name *Hetocresol* it has been employed medicinally.

***p*-Cresyl Iso-butyrate**, $\text{CH}_3 \cdot \text{C}_6\text{H}_4 \cdot \text{OOC} \cdot \text{CH} \cdot (\text{CH}_3)_2$, is an oil having an intense odour of narcissé-ylang type in which compounds it may be used.

***o*-Cresyl Oxide**, $(\text{C}_7\text{H}_7)_2 \cdot \text{O}$, is a substance having a geranium odour and in use is similar to diphenyl oxide (*which see*). It boils at 275°C .

***m*-Cresyl Phenylacetate**, $\text{C}_7\text{H}_7 \cdot \text{OOC} \cdot \text{CH}_2 \cdot \text{C}_6\text{H}_5$, has an odour recalling ylang-ylang and is employed in the preparation of exotic perfumes. In traces it is also useful for toning down the harshness of benzyl acetate, to which it imparts greater persistence. The crystals melt at 51° to 52°C .

***p*-Cresyl Phenylacetate**, $\text{C}_6\text{H}_5 \cdot \text{CH}_2 \cdot \text{COO} \cdot \text{C}_7\text{H}_7$, in the pure state is a crystalline body melting at 74° to 75°C . It has a faint odour resembling narcissus, and as a base for this perfume is superior to the *acetate*. It does not possess the disagreeable odour suggestive of urine which is associated with the latter product, even when in a high state of purity. In practice much larger proportions of the phenylacetate may be used. This body is invaluable in many flowery soap compounds, particularly jasmin and narcissus. It is prepared by heating a mixture of freshly distilled *p*-cresol and phenylacetyl chloride until the evolution of hydrogen chloride ceases. The mixture is cooled and poured with rapid stirring into N_6 sodium hydroxide solution.

Crocus—*see* Saffron.

Crops—*see* Volume II.

Cubeb Oil is obtained by distillation of the berry-like fruits of *Piper cubeba*, Lf., N.O. Piperaceæ, climbing shrubs growing in the East Indies. They appear to be cultivated in particular in Borneo, Java, and Sumatra, but exact information concerning this is difficult of access;

small quantities are produced in Mysore. Whilst the fruits are still unripe, but full grown, they appear to be collected from the plant. The projecting portion of the pericarp comes away with them and is a characteristic of the commercial specimens. The green fruits are then spread out in the sun to dry, when they turn a greyish-black and are subsequently exported from Singapore and Batavia. Cubebs are known as "**Tailed Pepper**." They yield from 10 to 16 per cent of a colourless to pale green essential oil having a characteristic pepper-like odour. An oleo-resin may also be extracted from them to the extent of about 20 per cent. Cubeb oil distilled in Mysore has been examined by Simonsen¹ who gives the following approximate composition: *d*-sabinene (33 per cent), *d*- Δ^4 -corene and 1 : 4-cineole (12 per cent), *d*- Δ^1 -terpinen-4-ol and other alcohols (11 per cent.), sesquiterpenes mainly *l*-cadinene (14 per cent), sesquiterpene alcohols (17 per cent), unidentified (13 per cent). Cubeb oil has not a very extensive use in perfumery. It may, however, be employed in soaps (traces) in the same way as oil of pepper.

Cucumber Juice is obtained by expression from the fresh cucumber *Cucumis sativus*, a trailing annual of the N.O. Cucumbitaceæ. After clarification, alcohol, benzoic or salicylic acids are added as preservatives. The juice is used in the preparation of glycerine and cucumber creams described in the second volume of this work. Cucumbers possess a peculiar odour which is extracted and used in blending certain bouquet perfumes. Concentrated cucumber perfume is made by the repeated extraction of the freshly sliced fruit with strong alcohol and subsequent concentration by distillation *in vacuo*. It is naturally very expensive.

Cudbear is a purplish-red powder, prepared by evaporating an ammoniacal infusion of *Rocella tinctoria* D.C. and other lichens of the N.O. Discomycetes to dryness and

¹ "P. and E.O.R.," 1928, 141.

afterwards reducing to powder. Tinctures prepared by maceration or percolation with alcohol produce a colouring matter which is not affected by acids.

Cuir de Russe.—In Russia an oil (probably Birch Tar) is added to materials used in tanning leather with a view to covering their objectionable odour. The following formula will indicate the lines on which a compound of this type may be built up:—

100	Birch tar oil—rectified.
300	Bergamot.
200	Petitgrain—French.
100	Rhodinol.
100	Benzyl acetate.
30	Jasmin absolute.
20	Rose otto.
50	Musk ambrette.
100	Styrax.
<u>1000</u>	

Cumic Aldehyde (*Cuminol* or *p-isopropyl-benzaldehyde*), $(\text{CH}_3)_2\text{CH} \cdot \text{C}_6\text{H}_4 \cdot \text{CHO}$, occurs to the extent of about 30 per cent in cummin oil, and it has also been found in traces in the oils from cassie flowers, cinnamon, myrrh, and probably boldo leaf. S.G., 0.9818; B.P., 232°C . Its odour recalls orris, and it is useful in preparing synthetic cassie, orris, foin coupe, lilac, lily, mimosa, and violet perfumes. An example of cassie is appended.

200	Bois de rose oil.
250	Methyl salicylate.
300	Benzyl alcohol.
50	Ionone Beta.
5	Cinnamyl butyrate.
5	Laurinic aldehyde.
100	Petitgrain oil—French.
40	Anisic aldehyde.
10	Cumic aldehyde.
40	Orris oil—concrete.
<u>1000</u>	

Cuminacetaldehyde—see Cymylactic Aldehyde.

Cumin Oil is distilled from the fruit of *Cuminum Cyminum*, L., N.O. Umbelliferæ, a plant cultivated in Malta, North-eastern Africa, and India. It is a limpid, pale yellow liquid with the characteristic odour of the fruit, and contains cymene and cumic aldehyde. The average yield of oil is between 3 and 4 per cent. Traces of it are useful in compounding synthetic cassie, and may if desired replace cuminic aldehyde.

Cuminol—see Cumic Aldehyde.

Curcuma Oil.—Oil of turmeric is obtained by distilling the rhizomes of *Curcuma longa*, L., N.O. Scitaminæ, a plant grown in the East Indies and Cochin China. After the rhizomes are dug up they are boiled to destroy their vitality which is very persistent. They are then dried in the sun or by artificial heat. The rhizomes are of two kinds—long and round; they are largely employed as a dye and to some extent as a condiment. The volatile oil is present to the extent of about 5 per cent; it is stated to be much employed by Egyptians in perfuming the red slippers sold in their bazaars. The colouring principle is called *Curcumin*; it is soluble in alcohol, and on the addition of alkalis the yellow solution is turned to reddish-brown. A tincture of turmeric is prepared by macerating the rhizomes in alcohol, this is sometimes used for colouring face powders.

Cus Cus—see Vetivert Oil.

Cyclalia—see Hydroxy Citronellal.

Cyclamal—see Cyclamen Aldehyde.

Cyclamen is the name given to an exceptionally pretty genus of flowering plants which are found growing wild in the Alpine regions, but are much cultivated in greenhouses in this country. They belong to the N.O. Primulaceæ, and the Sowbread *C. Europæum* is one of the best known, having reddish-purple flowers, the lobes of the corolla being reflexed. Some of the varieties of this species are very fragrant, but there is little doubt that another species,

C. persicum, is the most powerfully scented. The flowers of *C. Europæum* were extracted with petroleum ether by O. Gerhardt¹ who obtained a yield of 0.18 per cent of a greyish-yellow wax-like substance having a remarkably strong odour; one shade of this was somewhat similar to jasmin, but another note which predominated was sullen like the humus under forest trees. The odour of cyclamen recalls that of a bouquet composed of lily and violets, with sometimes just a suspicion of hyacinth. The principal constituents of synthetic cyclamen will therefore be hydroxy citronellal, ionone, linalol, terpineol, and either cinnamic alcohol, or phenylacetic aldehyde. The genus *Cyclamen* is dealt with at length in a separate monograph in Volume II.

Cyclamen Aldehyde, $(\text{CH}_3)_2\text{CH} \cdot \text{C}_6\text{H}_4 \cdot \text{CH}_2 \cdot \text{CH}(\text{CH}_3) \cdot \text{CHO}$, known also as iso-propyl alpha-methyl hydrocinnamic aldehyde, is a powerfully odorous liquid of flowery fragrance. It is invaluable in muguet and cyclamen type perfumes and being stable is much used in soaps. It is synthesised from cuminic aldehyde and is sometimes designated **Cyclamal**.

Cyclohexanol, $\text{C}_6\text{H}_{11}\text{OH}$, is a colourless, somewhat viscous liquid of slight and not unpleasant odour. It boils at 160°C ., and is chemically hexahydrophenol. It may be obtained by the reduction of carbolic acid with hydrogen. Cyclohexanol is a good solvent and would appear to be useful for extracting the odours from flowers. Its present commercial value lies in the fact that when added to soap in small quantities it increases its cleansing value by dissolving considerable proportions of various hydrocarbons. Cyclohexanol soaps are therefore an ideal detergent and scouring agent for woollen fabrics. In the varnish trades it is used as a solvent for nitrocellulose. S.G., 0.940; B.P., 160°C .

Cyclohexanyl Acetate, $\text{C}_6\text{H}_{11}\text{OOC} \cdot \text{CH}_3$, is a good solvent and will dissolve celluloid, which suggests its use

¹ "P. and E.O.R." (1929), 317.

in the preparations of nail varnishes. It possesses the disadvantage of slower evaporation than amyl acetate but is pleasanter to use on account of its mild odour. S.G., 0.950; B.P., 190° C.

Cyclohexanyl Butyrate, $C_6H_{11} \cdot OOC \cdot C_3H_7$, is an oily liquid of heavy odour used in jasmin bouquets. The iso-butyrate is more suitable for opoponax and amber types.

Cyclopentadecanon—see Muskone.

Cyclosia—the original Hydroxy Citronellal.

Cymbopogon Oils—see Palmarosa, Ginger-grass, Lemon-grass, Citronella, etc.

Cymene, $p\text{-CH}_3 \cdot C_6H_4 \cdot CH(CH_3)_2$, is a hydrocarbon found in the oils of cumín (*which see*), aniseed, coriander, cinnamon, thyme, etc.

Cymylacetic Aldehyde, $(CH_3)_2CH \cdot C_6H_4 \cdot CH_2 \cdot CHO$, is obtained by condensing magnesium cymyl chloride with ethyl orthoformate, hydrolysing the product with dilute sulphuric acid and separating the aldehyde by means of its bisulphite compound. It is a pale yellow liquid having an odour of verbenā, but it seems doubtful whether its use will ever be important in view of the cheapness of lemon-grass oil.

Cyperus is the name of a genus of several species of the sedge family (Cyperaceæ), widely distributed throughout the tropical and sub-tropical regions of both hemispheres. Among the odorous species are *C. rotundus*, L., and *C. scariosus*, L., both common in certain parts of India, where the dried and powdered roots are used as a perfume by the Indian ladies for their hair and clothes. The former, known as "Seid," also grows in great profusion in the Sudan, and according to Joseph and Whitfield,¹ often becomes a pest on irrigated land. They found the rhizomes to contain 0.5 per cent of volatile oil in which the odour

¹ "J. Soc. Chem. Ind." (1922), 41, 144, 172.

of camphor could be detected. The rhizomes are apparently used medicinally, and also as a perfume for fabrics which are dyed. According to Sawer,¹ an essential oil is extracted which is used for the same purpose. The roots are said to be used in preparing lavender water in Britain. *C. longus*, L., is a British species, known as "English galin-gale." When broken, it is stated to have an odour resembling violets (*see* note under "Souchet"). According to Volkens² this plant is grown in the colony of Togo where the natives grind the roots to powder and mix it with different resins. The mixture is strewn on glowing coal, above which garments are suspended for the purpose of allowing them to become permeated with the perfume thus generated.

Cypress Oil is obtained by distillation from the leaves and young twigs of *Cupressus sempervirens*, Germany, *C. sempervirens* and *C. Pyramidalis*, France, and *C. lusitanica*, Kenya and Spain, N.O. Coniferæ, trees native of Western Asia and growing in Europe. The source of the French oil was investigated by Dr. E. S. Guenther,³ who advises perfumers to be careful and obtain the oil distilled from *C. sempervirens*, since oils from the other botanical source lack the high boiling sesquiterpene alcohol to which the ambergris-like odour is due. Cypress oil is a yellowish viscous liquid with a characteristic aroma, which recalls that of the oleo-resinous exudation from the leaves and young stems of *Cistus Creticus* and *C. ladaniferus*. On evaporation it distinctly resembles ambergris.

The oil has been subjected to a detailed analysis by Schimmel & Co.⁴ who identified the following constituents: furfural, pinene, camphene, sylvestrene, cymene, a ketone, sabinol? an alcohol, esters of terpineol, and cedrol. Recently the oil distilled in Kenya from *C. lusitanica* has appeared on the-European market, and owing to its fine

¹ "Odorographia," ii. 319.

² "Report" of Schimmel & Co., April (1911), 144.

³ "American Perfumer," August (1932), 319.

⁴ April "Reports" (1904), 36; (1910), 46; (1913), 50.

odour of limes and pines has found some industrial application. This oil has been examined by Sfras¹ in the laboratories of Roure-Bertrand Fils, and the terpene fraction representing 64 per cent consists of the following: *a*-pinene, 22 per cent; Δ^3 -carene, 18 per cent; *d*-limonene, 8 per cent, and the remainder of camphene, cymene, myrcene, and *a*-terpinene. It is used medicinally, but its value as a perfume fixator appears to have been overlooked. Cypress oil is useful in artificial ambers of which an example follows:—

150	Bergamot.
50	Sweet orange.
70	Sandalwood.
10	Clary sage.
50	Cypress.
50	Labdanum R.
20	Patchouli.
30	Vetivert.
100	Peru balsam.
80	Tolu balsam.
70	Benzoin R.
40	Rhodinol.
120	Vanillin.
80	Coumarin.
30	Styrax.
50	Musk ambrette.
<u>1000</u>	

Daffodil—see *Narcissus*.

Darwinia Oils are obtained by distillation from the fresh leaves and twigs of *Darwinia fascicularis*, Rudge, *D. taxifolia* var. *grandiflora*, Benthams, and other species of the N.O. Myrtaceæ, plants attaining a height of up to fifteen feet and found growing in different parts of New South Wales. They were first examined by Baker and Smith² in the year 1899 and were found to contain about 60 per cent of geranyl acetate and 13 per cent of geraniol. More recently the chemistry of these oils has been investi-

¹ "Recherches," 5, 17.

² "Year Book of Pharmacy" (1901), 60.

gated by A. R. Penfold¹ who obtained a yield of up to 0.5 per cent of a very aromatic distillate. These oils are of considerable indirect interest to the perfumer since they may one day become a source for the manufacture of Geranyl Esters.

Daucus Oil—*see* Carrot Seed Oil.

Davana Oil has been distilled from a species of *Artemisia* in the Mysore Factory at Bangalore. A yield of 0.12 per cent was obtained from flower heads, leaves, stalks, etc. It was dark in colour, and had a strong, persistent, and highly penetrating odour.

Decahydro-b-Naphthyl Acetate, $C_{10}H_{17} \cdot OOC \cdot CH_3$, is an oil having an intense and somewhat crude odour of jasmin type. In combination with benzyl acetate, linalyl acetate, and amyl cinnamic aldehyde it is of use in soap compounds but only those for a cheap market.

Decahydro-b-Naphthyl Formate, $C_{10}H_{17} \cdot OOC \cdot H$, is an oil having a powerful odour of sandalwood type. In combination with santal, vetivert, patchouli, and musk ambrette, it is useful for preparing cheap soaps. It is known also as **Santalozone**.

Decyl Acetate, $CH_3 \cdot (CH_2)_8 \cdot CH_2OOC \cdot CH_3$, is a liquid having a sharp orange-rose odour. It may be used as a modifier in jasmin and fancy bouquets. B.P., 189° C.

Decyl Alcohol, $CH_3 \cdot (CH_2)_8 \cdot CH_2OH$, is a solid, melting at 15° C., and is one of the higher aliphatic alcohols which, together with other members of the series, are now well established in perfumery. The odour of alcohol C_{10} may be said to be full and sweet, with a background of orris. Its use cannot be said to be confined to any particular type of perfume, although in synthetic rose, violet, and neroli up to about 1 per cent gives excellent results, while for some types of rose as much as 5 per cent may be used. The addition of mere traces of this alcohol to many more or less commonplace

¹ "P. and E.O.R." (1924), 186.

perfumes will produce an odour of distinction. Decyl alcohol probably occurs in traces in neroli oil. S.G., 0.8357; B.P., 231° C. It is known also as caprinic alcohol.

Decyl Aldehyde, $\text{CH}_3 \cdot (\text{CH}_2)_8 \cdot \text{CHO}$, is an oily liquid having an intense odour of orange type and is employed in traces for perfecting the synthetic floral compounds of cassie, jasmin, violet, neroli, and rose. It occurs in certain essential oils, of which coriander, cassie, orange, orris, lemon-grass, and rose are good examples. This aldehyde should be kept in 10 per cent solution with absolute alcohol or ethyl phthalate, otherwise it will rapidly deteriorate, and rather than enhance, will spoil any perfume to which it is added. On oxidation it yields caprinic acid. S.G., 0.830; B.P., 208° C.

Decyl Formate, $\text{CH}_3 \cdot (\text{CH}_2)_8 \cdot \text{CH}_2\text{OOC} \cdot \text{H}$, has properties similar to the acetate, excepting that the odour is a little sweeter. S.G., 0.8751. It is very useful in neroli and orange blossom compounds.

Dextrin generally occurs commercially as an amorphous, odourless, colourless, and tasteless substance, soluble in water and not coloured by iodine. There are three well-defined varieties: corn, potato, and tapioca, made from their respective flours. In the manufacture of dextrin from starch, the flour is moistened with dilute acid or alkali, depending on the type required, and roasted in rotary kilns. In this manner the starches are hydrolysed to dextrins. Continued heating would produce a sugar-dextrose. Dextrines are largely used as adhesives when dissolved in water. They make a useful addition to mud packs and to some hair fixers.

Diacetone Alcohol (diketone alcohol), $\text{CH}_3 \cdot \text{CO} \cdot \text{CH}_2 \cdot \text{C}(\text{CH}_3)_2 \cdot \text{OH}$, is an almost odourless liquid used as a solvent in the lacquer industry. To some small extent also it is used in the production of nail enamels. S.G., 0.925; B.P., 164° C.

Diacetyl, $\text{CH}_3 \cdot \text{CO} \cdot \text{CO} \cdot \text{CH}_3$, is an aliphatic diketone found in traces in the essential oils of angelica root, caraway, clove, cypress, and sandalwood. Its presence is, like furfural, probably due to the decomposition of plant products in the course of distillation. According to O. Gerhardt,¹ it has been shown to be the typically aromatic constituent of butter. It has a low boiling-point of 88°C . and when very pure may be used in light fresh fruity perfume bouquets. It is also of value in the flavouring industry.

Dianthine is a well-known speciality having a remarkably powerful odour of the carnation type. It is universally used.

Diethylene Glycol $(\text{CH}_2 \cdot \text{CH}_2 \cdot \text{OH})_2\text{O}$, is a colourless, hygroscopic and almost odourless liquid having a specific gravity of 1.121 and B.P., 244°C . Aqueous solutions are used in the hairdressing trade for softening the hair before water and permanent waving. It is said that this organic substance will dissolve oxygenated products to the exclusion of terpene derivatives, the former being subsequently washed out with water.

Diethylene Glycol Monoethyl Ether, $\text{C}_2\text{H}_5\text{O} \cdot \text{CH}_2 \cdot \text{CH}_2 \cdot \text{O} \cdot \text{CH}_2 \cdot \text{CH}_2 \cdot \text{OH}$, known more commonly as carbitol, is a colourless, slightly hygroscopic liquid of mild and pleasant odour. It is used in cold and cleansing creams, after shaving creams, etc., because it retards the drying of the cream and has a softening and soothing action upon the epidermis. It does not cause stickiness and is non-irritant. In cosmetics containing tinting dyes, carbitol, being a dye solvent, increases the spreading power and the intensity of the dye and moreover gives the product a uniform colour. In cleansing creams it facilitates the removal of oil and dirt. S.G., 1.025 at 20°C . ; B.P., 180°C . Miscible with water in all proportions. This ether is used as the solvent for eosine (acid) in lipsticks.

¹ "P. and E.O.R.," March (1931), 64.

Diethyl Phthalate—*see* Ethyl Phthalate.

Diglycol Stearate is a white wax-like substance having an important application in the cosmetic industry where it is used as an emulsifying agent. It is very useful in the production of non-greasy cold creams, skin foods, tissue creams, honey and almond creams, and lanoline milks.

Di-Hexyl Ketone, $C_6H_{13} \cdot CO \cdot C_6H_{13}$, is a crystalline substance melting at 28° C. and possessing an odour of the May blossom type. By adding 5 per cent of it to such compounds more accurate reproductions of the odour are possible.

Dihydro Citronellol—*see* Dimethyl Octanol.

Dihydro Coumarin is a colourless liquid of fine Tonka odour, and may be successfully employed in compounds of the fern, chypre and briar types.

Dihydrofarnesol is an amber-coloured oil having an odour reminiscent of cedarwood. This aliphatic sesquiterpene alcohol was first prepared by Verley who obtained it by reducing the glycidic esters of farnesal with sodium.

Dihydro Geraniol is a liquid of sweet rose odour and is much appreciated in artificial rose compounds.

Dill Oil is distilled from the ripe fruits of *Peucedanum graveolens*, Benth. and Hooker, f., a herb of the N.O. Umbelliferae, cultivated in England and largely in Germany and Holland. A yield of about 3 per cent is obtained. It consists largely of carvone and is sometimes used in soap perfumery in place of caraway oil.

Dimethyl Acetophenone, $CH_3 \cdot CO \cdot C_6H_3 \cdot (CH_3)_2$, is a liquid having an intense odour of mimosa type. It is used very much as methyl metophenone, but has a much finer fragrance.

Dimethyl Anthranilate—*see* Methyl Methyl Anthranilate.

Dimethyl Benzyl Carbinol, $C_6H_5 \cdot CH_2 \cdot C(CH_3)_2 \cdot OH$, is a colourless or yellowish liquid having an odour recalling lilac, lily of the valley, and hyacinth, in which compositions it may be used. S.G., 0.982; B.P., 215° C. Here is an example of lilac :—

300	Dimethyl benzyl carbinol.
300	Hydroxy citronellal.
200	Terpineol.
100	Cinnamic alcohol.
50	Benzyl acetate.
10	Iso-eugenol.
40	Amyl cinnamic aldehyde.
1000	

Dimethyl Benzyl Carbinyl Acetate, $C_6H_5 \cdot CH_2 \cdot C(CH_3)_2 \cdot OOC \cdot CH_3$, has an odour of the hyacinth type and is useful in this and lilac compounds. S.G., 1.00; B.P., 122° C. at 4 mm.

Dimethyl Hydroquinone (hydroquinone dimethyl ether), $C_6H_4(OCH_3)_2$, is a crystalline solid, melting at 55° to 57° C. Its odour recalls that of melilot, and new-mown hay. This is extraordinarily persistent and valuable in fougere, opoponax, and amber compositions. It will take the place of coumarin if carefully used, and blends well with musk. The shading of odour suggestive of anise would appear to give it possibilities in fine perfumery, particularly in scents of the type of Tobacco Flower (*which see*).

Dimethyl Octanol, $C_7H_{13}(CH_3)_2 \cdot CH_2OH$, known also as dihydro citronellol, tetrahydro geraniol and pelargol, is a liquid of intense rose odour. It has a S.G. of 0.848 and is isomeric with decyl alcohol. When blended with other rose alcohols it functions admirably in cosmetic and soap compounds. It is probably the cleverest adulterant of rose otto.

Dimethyl Phenyl Carbinol, $C_6H_5 \cdot C(CH_3)_2 \cdot OH$, is a colourless substance melting at 35° to 37° C. It has a flowery rose-like odour and may be used in this type of compound.

Dipentene, $C_{10}H_{16}$, is a relatively stable terpene, having a pleasant though weak odour. It is the optically inactive form of limonene and is a common constituent of many essential oils. It is a useful constituent of cheap soap perfumes.

Diphenyl Ketone—*see* Benzophenone.

Diphenyl Methane, $(C_6H_5)_2 \cdot CH_2$, is a crystalline substance, melting at $26^\circ C.$ and boiling at $262^\circ C.$, and may be prepared synthetically by the reduction of benzophenone with zinc dust. It has an odour which recalls both orange and geranium simultaneously and is softer than the oxide. It is largely used in preparing synthetic pelargonium oil, and finds a place in traces in some floral ottos. It blends well with coumarin, dimethyl hydroquinone, and hydroxycitronellal. Its principal use, however, is in soap perfumery, where it will replace geranium oil in part and will strengthen a compound successfully. It is not affected by traces of alkali, and is therefore useful in cheap soaps. It blends well with all the recognised soap perfume constituents. An example of a rose soap compound containing it is appended :—

400	Palmarosa.
200	Geranium—African.
150	Phenylethyl alcohol.
30	Patchouli.
20	Clove.
100	Terpineol.
50	Diphenyl methane.
50	Musk xylene.
<u>1000</u>	

Diphenyl Oxide, $C_6H_5 \cdot O \cdot C_6H_5$ (diphenyl ether), is a crystallisable solid melting at $27^\circ C.$, and boiling at $255^\circ C.$, and may be prepared synthetically by distilling aluminium phenate or by passing phenol vapours over thorium oxide. It has an odour of geranium, but is much harsher and more penetrating than the methane. It is cheap and therefore finds extensive application in soap perfumery. In

use it is very stable. Diphenyl oxide may be employed as indicated in the foregoing monograph. It is also used in preparing geranium oils ; about 1 per cent is useful in foin coupé floral oils. It is known sometimes as **Geranium Crystals**, and the intensity of its odour is about ten times that of the bourbon oil.

Dipteryx Odorata—see Tonka Beans.

Distillation—see Volume II.

Ditolyl Methane ($\text{CH}_3 \cdot \text{C}_6\text{H}_4$)₂ . CH_2 , is a yellowish-white limpid liquid boiling at 300° C. and possessing an odour similar in type to that of phenylethyl alcohol. It is very cheap and makes a useful substitute in rose soaps. An example follows :—

300	Geranium—African.
200	Palmarosa.
150	Geraniol—Java.
150	Ditolyl methane.
50	Lemon-grass.
100	Terpineol.
10	Clove.
10	Patchouli.
30	Musk xylene.
<u>1000</u>	

Douglas Fir Oil is obtained by distillation from numerous species of red fir which are widely distributed in North America. Several species are grown in Britain, and in particular the leaves of the *Oregon Douglas Fir* are fragrant and possess an odour recalling pine-apples. With a view to determining the aromatic bodies producing this odour, C. T. Bennett¹ distilled an oil which on examination showed 31.5 per cent of alcohols calculated as geraniol. The presence of bornyl acetate somewhat masked the odour of this alcohol in the original oil, and in addition to these bodies he found traces of citral. The peculiar fragrance is therefore chiefly due to the geraniol, slightly modified by the small amount of bornyl acetate present.

¹ "P. and E.O.R.," 11 (1920), 218.

Duodecyl Alcohol, $\text{CH}_3 \cdot (\text{CH}_2)_{10} \cdot \text{CH}_2\text{OH}$, is a solid substance which begins to liquefy at 20°C . It possesses an odour recalling tuberose with a suggestion of violet, and is used in compounding these perfumes. Traces are also employed in narcissus and lily compositions. A full range of esters of this alcohol is now available and offer great possibilities to the experimenter. B.P., 257°C .; S.G. at 25°C . about 0.834. It is known also as lauric or laurinic alcohol.

Duodecyclic Aldehyde, $\text{CH}_3 \cdot (\text{CH}_2)_{10} \cdot \text{CHO}$, also known as lauric aldehyde, is a solid at normal temperatures and melts about 44°C . In the pure state it possesses a rather objectionable fatty odour, but when much diluted this becomes comparatively pleasant and recalls the earthy odour associated with wood violets. Aldehyde C_{12} is employed, in traces, for jasmin, muguet, lilac, and tuberose compounds and fancy bouquets, but its chief use is perhaps in violet oils, to which it imparts an unusual persistence. For this particular purpose about $\frac{1}{2}$ per cent will be found sufficient. It has been identified in pine-needle oil. B.P., 121°C . at 10 mm.

Dyestuffs.—In the preparation of cosmetics a tint is frequently required which cannot be obtained by means of pigments; nor is the use of insoluble colours always desirable. The employment of an approved and non-allergic dyestuff must therefore be resorted to. In Britain a wide range of colours is manufactured by I.C.I., who will be only too pleased to advise cosmetic manufacturers on the type suitable for their purpose. The Food and Drugs Administration in the U.S.A. have issued a list of approved colouring materials, so that perfumers should ascertain the details of this list if they market their goods in America. Such a list has appeared in several English Perfumery Journals.

Eagle-Wood is obtained from *Aquilaria Crassna*, Pierre, a tree belonging to the N.O. Thymeleaceæ, and found in

parts of Cambodia and southern Annam. It is the Kynam of the Annamites and is subject to attacks by an unknown disease when secretions of resin appear. In this condition it has a fine penetrating odour of incense and fetches a high price locally.

Eau de Sureau is elder flower water.

Eglantine.—This name has been used as a pseudonym for such products as iso-butyl phenylacetate and iso-butyl benzoate.

Elder Flowers from *Sambucus nigra*, L., a deciduous shrubby tree common to the country-sides of Britain, and belonging to the N.O. Caprifoliaceæ, yield on distillation an oil which is present in minute traces only. This possesses the characteristic honey-like but somewhat sickly odour of the flowers. It is most fragrant on extreme dilution. A hot alcoholic extract of the blossoms, leaves, bark, etc., has been found to contain a glucoside yielding benzaldehyde similar to amygdalin. The black berries are made into wine and also used for colouring port wines. The water obtained by distilling the flowers is used in medicine and some toilet preparations. A synthetic elder flower oil may be made on the following lines :—

400	Rhodinol.
150	Terpineol.
200	Anisic aldehyde.
50	Geranyl acetate.
50	Benzyl acetate.
40	Honey compound.
20	Methyl anthranilate.
20	Jasmin absolute.
30	Rose absolute.
10	Musk ambrette.
30	Coumarin.

1000

Elecampane Oil is distilled from the roots and rhizomes of *Inula Helenium*, L., perennial plants of the

N.O. Compositæ, indigenous to Europe and Central Asia but naturalised in the United States. The plant is known as Scabwort, Elfwort, and Horse-heal, and is cultivated for medicinal purposes in Switzerland, Germany, and Holland. The oil is comparatively rare, and the author was indebted to M. Pierre Dhumez for a sample some short time ago. It was a dark yellow viscous liquid, readily solidifying and having an odour suggestive of costus, cistus, and orris. The principal constituent is alantol which has a minty odour. Messrs. Schimmel & Co.¹ obtained a yield of 0.896 per cent of oil which solidified at 41.6° C.

Elemi is a concrete (sometimes semi-liquid), resinous exudation from *Canarium luzonicum*, Gray, N.O. Burseraceæ, a tree grown almost entirely in the Philippine Islands and known as "Manilla Elemi." The resin is exuded by the tree most freely when the leaves are developing, *i.e.* about January and June. The natives then make incisions in the trunk with tools known as "bolos." The resin exudes from these cuts and is collected every few days before it has darkened or become dirty. A full-grown tree will yield from 4 to 5 kilos per annum. Should the elemi become dirty, it is cleaned by solution in benzine, filtration and removal of the solvent by distillation.² When fresh it is fragrant, soft, white, and granular, but with age it becomes harder and yellow in colour. It yields about 10 per cent of an essential oil containing a crystalline sesquiterpene alcohol, elemol, with an odour recalling fennel. Elemi is useful as a fixative in a few perfumes, notably verbena and heather bouquets, but should not be used as imported. The following method of preparation will be found satisfactory: To 100 grams add an equal weight of alcohol; macerate with frequent shaking for one week; filter bright, discarding the residue on the filter paper. This tincture may also be employed in soap per-

¹ "Report" (1931), 20.

² For a complete account consult the author's article in the "American Perfumer," August (1924), 311.



[Roure-Bertrand Fils.

FIG. 11.— Manufacture of Pomades (Infleurance).

[To face page 165.

fumery. An example of its use in a verbena compound is appended :—

400	Lemon-grass oil.
50	Citronella oil—Ceylon.
10	Benzaldehyde.
200	Lemon oil.
300	Terpineol.
40	Tincture of elemi.
<u>1000</u>	

Elemi resinoid of brilliant yellow clarity is now prepared ready for use by most of the Grasse houses.

Encens—*see* Olibanum.

Enfleurage is the process by which “Pomades” are made. A thin layer of lard or other fat is uniformly distributed on the surface of glass trays, which are then covered with fresh flowers. These are renewed periodically until the fat becomes fully charged with the flower perfume. It constitutes the so-called “pomade” from which the first, second, and third infusions or “washings” are made. For full details of the process consult Volume II.

Eosine is the potassium salt of tetra-brom-fluorescein, $C_{20}H_6O_5Br_4K_2$, a dye used largely in making red ink and having a yellowish-brown tint compared with erythrosine. Useful for tinting pink face powders. The fact that this dyestuff in the acid form is soluble in diethylene glycol monoethyl ether is made use of in lipsticks. This eosine is commonly known as *Bromo Acid*.

Eriocephalus Africanus belongs to the family Compositæ, which comprises seventeen species of shrubby plants, thickly branched, resistant to the cold and all indigenous to Eastern Africa. The above species is cultivated on the Riviera for its beautiful white flowers, and an agreeable balsamic odour is emitted by the leaves when rubbed between the fingers. A preliminary examination of the shrub has been made by Trabaud and Sabetay,¹ who extracted it with

¹ “P. and E.O.R.” (1939), 171.

volatile solvents. The whole plant yielded 0.3 per cent of a green concrete oil which on steam distillation *in vacuo* gave 10 to 15 per cent of a yellowish viscous essential oil having a herbaceous, balsamic odour reminiscent of the decoctions of tea, of pine and of dried herbs.

Erythrosine is tetra-iodo-fluorescein, a brilliant red water-soluble dye, similar to eosine and phloxine, useful in preparing liquid rouges.

Esculin is a glucoside obtained from the inner bark of the horse-chestnut, *Æsculus Hippocastanum*, L., N.O. Hippocastaneæ. It is a white crystalline substance, has a bitter taste, and in solution has a faint blue fluorescence. M.P. about 200° C. Very soluble in hot water and especially so in the presence of alkalis. Five per cent added to vanishing creams is said to make an excellent anti-sun-burn preparation.

Essence de Portugal is sweet orange oil.

Estragon—see Tarragon Oil.

Ethanolamine was first made and described by Knorr in 1897. During recent years this product has been developed extensively and has now a wide application in the cosmetic and soap industries. In commerce it occurs as a mixture of mono-, di-, and tri-ethanolamines, these compounds being synthesised from ammonia and fundamentally are substituted ammonia compounds, in which one or more

of the hydrogen atoms of the compound $\text{N} \begin{array}{l} \text{H} \\ \diagup \\ \text{H} \\ \diagdown \\ \text{H} \end{array}$ have been replaced by the ethanol group $\text{—CH}_2 \cdot \text{CH}_2 \cdot \text{OH}$. The commercial product contains approximately 5 per cent mono-, 18 per cent di-, and 77 per cent tri-ethanolamine. Some interesting data relative to the pure products is as follows :—

1. Mono-ethanolamine, $\text{NH}_2 \cdot \text{CH}_2\text{CH}_2\text{OH}$; M.W., 61 ; B.P., 171° C. at 757 mm.

2. Di-ethanolamine, $\text{NH} \cdot (\text{CH}_2\text{CH}_2\text{OH})_2$; M.W., 105; B.P., 217°C . at 150 mm.
3. Tri-ethanolamine, $\text{N} \cdot (\text{CH}_2\text{CH}_2\text{OH})_3$; M.W., 149; B.P., 277°C . at 150 mm.

The three differ slightly in their physical and chemical properties. They are miscible in all proportions with water, alcohol, acetone, glycerine, etc. No. 1 is a colourless liquid, slightly viscous and possesses a faint but agreeable ammoniacal odour. It is extremely hygroscopic. No. 2 is a colourless and odourless liquid of similar viscosity to glycerine. No. 3 when pure is a white crystalline solid at 15°C . Aqueous solutions of all three are strongly alkaline to phenolphthalein. The combination of any one of the ethanolamines with a fatty acid results in a neutral compound, but for technical purposes a mixture of the three possesses no disadvantages since their properties are similar. Commercially, therefore, tri-ethanolamine, containing the above proportions of mono and di, is almost invariably used. For further details consult Tri-ethanolamine.

Ethyl Acetate, $\text{CH}_3 \cdot \text{COOC}_2\text{H}_5$, commonly known as acetic ether, occurs naturally in many wines, in brandy and in wine vinegar. It is used principally in the manufacture of artificial fruit essences, notably cherry, peach, raspberry, and strawberry. It is also useful (in traces) in magnolia and ylang-ylang perfumes and for fruity bouquets. Ethyl acetate is now used as a fumigant in America, where it is employed in combination with carbon tetrachloride. This ester is also a good solvent for nitro cotton, and owing to its pleasant odour makes a useful addition in the production of nail enamel. Two kinds are obtainable, the one from duty-free alcohol and the other from industrial spirit. The latter has a specific gravity of 0.900 and boiling-point about 76°C .

Ethyl Aceto Acetate, $\text{CH}_3 \cdot \text{CO} \cdot \text{CH}_2 \cdot \text{COOC}_2\text{H}_5$, is a liquid having a sweet fruity odour. S.G., 1.0353; B.P., 272°C . It is used in perfumes of the gardenia type and toilet waters for imparting a fresh note.

Ethyl Amyl Carbinol, $C_2H_5 \cdot CHOH \cdot C_5H_{11}$, is an alcohol isomeric with octyl alcohol, and has been shown to occur naturally in Japanese peppermint oil. S.G., 0.825; B.P., 166° C.

Ethyl Amyl Carbinyl Acetate, $C_2H_5 \cdot CH(OOC \cdot CH_3) \cdot C_5H_{11}$, is a liquid of rosaceous odour and is used as a modifier. S.G., 0.8672; B.P., 80° C. at 14 mm.

Ethyl Amyl Ketone, $C_2H_5 \cdot CO \cdot C_5H_{11}$, has been shown to occur naturally in French lavender oil. It is a liquid of slightly pungent odour and may be used for giving a new note in fancy bouquets. S.G., 0.825; B.P., 170° C.

Ethyl Anisate, $C_6H_4 \cdot OCH_3 \cdot COOC_2H_5$, is a liquid substance with a pleasant odour of aniseed type, and is useful in lime blossom and fancy bouquets. It has a coarser odour than the methyl ester. S.G., 1.107; B.P., 270° C.

Ethyl Anthranilate, $NH_2 \cdot C_6H_4 \cdot COOC_2H_5$ (ethyl-*o*-aminobenzoate), is an oil with a distinct orange-flower aroma and is used in synthetic neroli and jasmin oils. Its odour is more delicate than that of the methyl ester, and it does not become discoloured so rapidly when compounded in the above products. S.G., 1.1235; B.P., 267° C. An example of its use in jasmin is given :—

300	Benzyl acetate.
100	Benzyl alcohol.
150	Linalol.
50	Ethyl anthranilate.
60	Phenylethyl alcohol.
10	Indole—10 per cent.
20	Jasmin absolute.
10	Aldehyde C_{10} —10 per cent.
100	Linalyl acetate.
200	Hydroxy citronellal.
1000	

Ethyl Benzoate, $C_6H_5 \cdot COOC_2H_5$, is a liquid substance boiling at 212° C. and is prepared synthetically. It has a smoother odour than the methyl ester (Niobe oil) and is useful in synthetic ylang-ylang. S.G., 1.052.

Ethyl Butyrate, $C_3H_7 \cdot COOC_2H_5$, commonly known as butyric ether, is one of the constituents of artificial essence of pine-apple, apricot, and peach. It is a liquid having a peculiar odour recalling that of certain species of rose. It is useful for modifying this type of perfume (traces). S.G., 0.886 ; B.P., $120^\circ C$.

Ethyl Caproate, $C_5H_{11} \cdot COOC_2H_5$, is a liquid having a fruity odour and is used in the preparation of artificial fruit essences. It is known also as ethyl hexoate. S.G., 0.876 ; B.P., $167^\circ C$.

Ethyl Caprylate, $C_7H_{15} \cdot COOC_2H_5$, is a liquid used in the production of fruit essences. It is known also as ethyl octoate. S.G., 0.871 ; B.P., $208^\circ C$.

Ethyl Cinnamate, $C_6H_5 \cdot CH : CH \cdot COOC_2H_5$, occurs naturally in storax and the volatile oil of *Kæmpferia galanga*. The commercial product is a liquid, boiling at $271^\circ C$., and is almost invariably prepared artificially. S.G., 1.053. It may be obtained by slowly adding benzaldehyde to sodium wire contained in excess of ethyl acetate. It has a sweet amber odour of great persistence. Ethyl cinnamate is useful in Oriental bouquets, and in combination with clary sage and *citrus* oils will make delightful amber colognes.

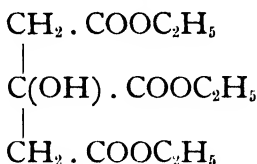
An example of its use in a face powder perfume of Eastern type is appended :—

10	Ethyl cinnamate.
10	Phenylacetic aldehyde.
100	Heliotropin.
50	Coumarin.
150	Benzyl acetate.
100	Bergamot oil.
20	Clove oil.
30	Patchouli oil—English.
20	Orange blossom absolute.
40	Rose otto—Bulgarian.
100	Musk extract—3 per cent.
70	Balsam of Peru.
300	Benzoin R.

1000

Ethyl cinnamate is used in soap perfumery, but as a rule the methyl ester is preferred. Use up to 15 per cent.

Ethyl Citrate is an odourless liquid generally employed as an adulterant of essential oils. Tri-ethyl citrate has the formula



It boils at 294°C .

Ethyl Decine Carbonate, $\text{C}_8\text{H}_{17} \cdot \text{C} : \text{C} \cdot \text{COOC}_2\text{H}_5$, is a liquid substance sometimes sold as "mignonette," and is useful up to 5 per cent in reseda floral ottos. It has a leafy smell and resembles methyl heptene carbonate, but is less pungent.

Ethyl Decylate, $\text{CH}_3 \cdot (\text{CH}_2)_8 \cdot \text{COOC}_2\text{H}_5$, is a colourless liquid having an odour of rose, into which compound it enters.

Ethylene Diamine, $\text{C}_2\text{H}_4(\text{NH}_2)_2$, is a new emulsifying agent, functioning in a similar manner to the ethanolamines. Vanishing creams prepared with it are exceptionally pearly. In solution it functions as a cuticle remover, and its use is less risky than caustic potash. As a solvent for shellac it finds application as hair lustre preparations. The monostearate is crystalline and flaky while the two oleates are viscous liquids.

Ethylene Glycol, $\text{C}_2\text{H}_4(\text{OH})_2$, is a somewhat viscous liquid, having a sweet taste and is miscible with water. It is used sometimes in toilet preparations in place of glycerine. S.G., 1.110; B.P., 197°C .

Ethyl Formate, $\text{H} \cdot \text{COOC}_2\text{H}_5$, is a liquid of fruity odour, used principally in the manufacture of artificial fruit essences and occasionally as a modifier in perfumes. It boils at 54°C .; S.G., 0.929.

Ethyl Furfhydracrylate, $C_4H_3O \cdot CH_2 \cdot CH_2 \cdot CO \cdot OC_2H_5$, is one of the newer organic bodies, having an odour of the type useful in cassie, orris, reseda, and violet compounds. It is a liquid having a specific gravity of 1.0628 and boiling-point of $90^\circ C.$ at 5 mm.

Ethyl Furoate, $C_4H_3O \cdot COOC_2H_5$, is a white crystalline substance melting at $34^\circ C.$ and having an odour resembling ethyl benzoate. It is suitable for use in those compounds where methyl benzoate would be too coarse.

Ethyl Heptene Carbonate, $C_5H_{11} \cdot C : C \cdot COOC_2H_5$, is a powerfully odorous liquid having an odour of the violet leaf type in extreme dilution. Its synthesis and uses are similar to those of methyl heptene carbonate (*which see*).

Ethyl Heptoate, or α -Nanthylic ether, $CH_3 \cdot (CH_2)_5 \cdot COOC_2H_5$, is sold as synthetic cognac. It is little used in perfumery, but has been recommended (in traces) as an addition to grain alcohol in the preparation of toilet waters. S.G., 0.872; B.P., $188^\circ C.$

Ethyl Hexoate—*see* Ethyl Caproate.

Ethyl Hexyl Carbinol—*see* Nonyl Alcohol.

Ethyl Hexyl Carbonyl Acetate—*see* Nonyl Acetate.

Ethyl Isoamyl Oxybutyrate is a liquid ester having a fine fruity odour. B.P., $132^\circ C.$ at 12 mm.

Ethyl Lactate, $CH_3 \cdot CHOH \cdot COOC_2H_5$, is a colourless liquid having a syrupy consistency and a slight odour. It is soluble in water, has an acid reaction, a specific gravity of 1.036, and boils at $154^\circ C.$ It is used as a middle boiling solvent in the preparation of lacquers and nail enamels. It is a useful solvent for dyestuffs in such preparations.

Ethyl Laurinate, $CH_3 \cdot (CH_2)_{10} \cdot COOC_2H_5$, is a yellowish liquid of pleasant odour and is useful in tuberose and fancy bouquets. A good fixative. S.G., 0.867; B.P., $269^\circ C.$

Ethyl Malonate, $CH_2(COOC_2H_5)_2$, is a liquid of apple odour and used in the preparation of this artificial fruit

essence. It boils at 198° C. and has a specific gravity of 1.061.

Ethyl Methyl Phenyl Glycidate—*see* Methyl Phenyl Glycidate of Ethyl.

Ethyl Myristate, $\text{CH}_3 \cdot (\text{CH}_2)_{12} \cdot \text{COOC}_2\text{H}_5$, is at normal temperatures a yellowish oil having a powerful violet-like fragrance. It possesses marked fixative properties, and is used as a constituent of those artificial violet compounds which are intended for perfuming toilet powders. M.P., 11° C. ; B.P., 295° C.

Ethyl Nonylate, $\text{CH}_3 \cdot (\text{CH}_2)_7 \cdot \text{COOC}_2\text{H}_5$, is a liquid of fruity rose odour which is occasionally used in compounding fancy bouquets. It is known also as Ethyl Pelargonate. S.G., 0.876 ; B.P., 228° C.

Ethyl Octine Carbonate, $\text{C}_6\text{H}_{13} \cdot \text{C} : \text{C} \cdot \text{COOC}_2\text{H}_5$. This product has been recently introduced into perfumery, and has an odour of the violet leaf type. *Compare* Methyl Heptene Carbonate.

Ethyl Octoate—*see* Ethyl Caprylate.

Ethyl Cœnanthate—*see* Ethyl Heptoate.

Ethyl Oleate, $\text{C}_{17}\text{H}_{33} \cdot \text{COOC}_2\text{H}_5$, is used principally as an adulterant of essential oils and has only a very weak flower note. Boiling-point about 340° C.

Ethyl Pelargonate—*see* Ethyl Nonylate.

Ethyl Phenylacetate, $\text{C}_6\text{H}_5 \cdot \text{CH}_2 \cdot \text{COOC}_2\text{H}_5$, is a liquid with a sweet honey-like aroma, suggestive of musk, and is useful in certain types of artificial rose otto, orange blossom, honey, and sweet-pea. It is also an excellent tobacco flavour. S.G., 1.037 ; B.P., 227° C.

Ethyl Phthalate, $\text{C}_6\text{H}_4(\text{COOC}_2\text{H}_5)_2$, is a colourless liquid having practically no odour. It has recently been introduced as a solvent for artificial musk, and is much used in the States as a denaturant for alcohol intended

for perfumery purposes. It boils at 296° C. and has a specific gravity of 1.124.

Ethyl Propionate, $C_2H_5 \cdot COOC_2H_5$, is a colourless, mobile liquid of fruity odour recalling rum and arrac. S.G., 0.892 ; B.P., 99° C.

Ethyl Protocatechuic Aldehyde, $C_2H_5O \cdot C_6H_3 \cdot OH \cdot CHO$, is a white crystalline substance melting at 77.5° C. It has a powerful odour of vanilla and is nearer to that of the bean than vanillin. It is useful in all cases where the latter could be employed and gives considerable bouquet to all compounds in which it is used. This substance is marketed by a German firm under the name **Bourbonal** and by a French firm under the name **Vanillal**. Strength about 4 to 1 of vanillin. It is known also as *ethyl* vanillin.

Ethyl Pyruvate, $CH_3 \cdot CO \cdot COOC_2H_5$, is a fragrant liquid used in fancy compositions. S.G., 1.08 at 14° C. ; B.P., 155° C.

Ethyl Salicylate, $C_6H_4 \cdot OH \cdot COOC_2H_5$, is a colourless liquid having an odour similar to but finer than winter-green oil and is useful in synthetic cassie. It boils at 234° C. and has a specific gravity of 1.136.

Ethyl Sebacate, $C_2H_5OOC \cdot (CH_2)_8 \cdot COOC_2H_5$, is a liquid used principally in the manufacture of fruit essences. S.G., 0.966 ; B.P., 307° C.

Ethyl Succinate, $\begin{array}{c} CH_2 \cdot COOC_2H_5 \\ | \\ CH_2 \cdot COOC_2H_5 \end{array}$, is a liquid used in the same way as the ethyl esters of citric and oleic acids. It boils at 217° C. and has a specific gravity of 1.046.

Ethyl Undecylate, $CH_3 \cdot (CH_2)_9 \cdot COOC_2H_5$, is a liquid having a powerfully sweet odour and finds application in fancy bouquet perfumes. S.G., 0.8703.

Ethyl Undecylenate, $CH_2 : CH \cdot (CH_2)_8 \cdot COOC_2H_5$, is a liquid substance which probably occurs naturally in costus oil. It has a powerful odour of the violet-ylang type. S.G., 0.882 ; B.P., 264° C.

Ethyl Valerianate, $C_4H_9 \cdot COOC_2H_5$, is a liquid of strong fruity odour and is employed in the preparation of artificial fruit essences. S.G., 0.872; B.P., 134° C.

Eucalyptole—see Cineole.

Eucalyptus Oil is distilled from the fresh leaves of *Eucalyptus globulus*, Lab., and other species¹ of the N.O. Myrtaceæ, trees growing in Australia and Tasmania and cultivated in Algeria, etc. This species, known to the Australians as **Blue Gum**, grows to a great height and the dry leaves yield up to 3 per cent of oil. The distillation is in many cases carried on in a crude manner, but recently modern stills have been introduced by a few firms. In the former case the source of heat is by direct fire and only occasionally is the steam generated by a separate boiler. The crude oil is rectified after treatment with alkali. This is very necessary since the presence of valeric and other aldehydes causes coughing. The principal constituent is cineole, together with pinene, etc. It is much used medicinally and is also occasionally employed as a flavouring agent in dental preparations. Cheaper oils containing phellandrene are used in soap perfumery and medicated soaps. An example of a dental flavour is appended :—

200	Eucalyptus oil.
100	Clove oil.
600	Peppermint oil—American.
40	Menthol.
10	Thymol.
50	Methyl salicylate.
<u>1000</u>	

There are in all about 200 species of eucalyptus, and of these the following are probably of most importance to the perfumer :—

E. Citriodora, Hook., is lemon scented and contains citronellal (about 60 per cent) and pinene. It may be used

¹ According to A. F. Collins ("Chemist and Druggist," 67 (1905), 103) over 90 per cent of the so-called globulus oils are distilled from *E. oleosa* and *E. dumosa*.

as a soap perfume when blended with benzaldehyde and terpeneol.

E. dives, Schau, is known as Australian peppermint oil and is imported largely for the preparation of synthetic thymol from the piperitone it contains (50 per cent). See also Phellandrene.

E. Phellandra, is known as narrow leaf peppermint oil, the first and second hour distillates being separated. The oil consists mainly of phellandrene, pinene, cineole, terpeneol, geraniol, esters, sesquiterpene and traces of piperitone. It is used in the mining industry and also as a soap perfume, disinfectant, etc.

E. Staigeriana, F. v. M., has an odour reminiscent of verbena and contains limonene, citral, geraniol, and its acetic acid ester. Blended with lemon-grass, clove, rosemary, and spike lavender it will make a good verbena soap perfume.

E. Macarthurii, Deane et Maiden, is rose scented, and consists principally of geranyl acetate and geraniol.

It should be noted that the chemistry and botany of the eucalyptus has been elucidated principally by our distinguished countrymen, Messrs. R. T. Baker and H. G. Smith.

Eugenol, $C_{10}H_{12}O_2$, is a yellow, somewhat viscous liquid, boiling at 252° to 254° C., occurring naturally to the extent of upwards of 85 per cent in clove oil, from which it may be separated by means of alkali. This phenol is very widely distributed in volatile oils, amongst which may be mentioned bay, pimento, cinnamon leaf, sassafras, patchouli, and magnolia kobus. It possesses the characteristic pungent odour of oil of cloves, is the basis of many carnation compounds, and is successfully employed in blending Oriental bouquets. Eugenol finds employment as a soap perfume but has a tendency to darken. To cover this many perfumers colour their soaps yellowish-brown. Large quantities of eugenol are used in the commercial production of vanillin. S.G., 1.071.

Everlasting Flower Oil is obtained to the extent of about 0.1 per cent on distilling the fresh flowers of *Helichrysum augustifolium*, D.C., N.O. Compositæ. The principal seat of the industry is Dalmatia where distillation was carried out for the first time in 1908 on the Island of Cherso. The plant grows wild on the Dalmatian Islands, particularly the above and Lussino. In Provence this plant is known as "Herbe de St. Jean" and grows particularly well in the Esterel where the harvest takes place between June and August. 15,000 kilos are treated annually at Grasse. It is also abundant in parts of Italy. The flowers have a brilliant yellow colour and a powerful characteristic fragrance. If the plants are not freshly distilled they ferment after 24 hours, but some Dalmatian producers prefer to leave the plant until this has taken place, an increased yield being expected. The essential oil is confined to the inflorescence and leaves. It is an intense olive-green liquid having an odour reminiscent of a mixture of rose, orange flower, and camomile. According to Heine¹ the principal constituent is nerol which occurs equivalent to 40 to 65 per cent of neryl acetate. The oil has been suggested as an economical source for this valuable perfumery product, but Grasse chemists, however, have been unable to confirm the presence of nerol. A very complete study of the oil has recently been made by Traubaud and Sabetay² which should be consulted for further details. Odoriferous oils can also be obtained from other species, for example, *H. stoechas* (orange coloured oil) has an odour suggestive of rose, lime and camomile and contains principally nonyl acetate, while *H. saxatile* is somewhat rosaceous but inclined to be acrid. Everlasting flower oil is used in perfumery, but not to any great extent. Perfumers employ it to give a characteristic flowery sweetness to some of their perfumes. It blends well with clary sage, patchouli and vetiver. Derivatives of clove oil also are useful as also coumarin and heliotropin. It should first be compounded on the following lines :—

¹ "Year Book of Pharmacy" (1909), 41.

² "P. and E.O.R." (1940), 249.

10	Everlasting flower oil.
5	Clary sage oil.
5	Rose otto—Bulgarian
10	Bergamot oil—terpeneless.
40	Coumarin.
25	Acetisoeugenol.
5	Benzoin R.
900	Alcohol.
<u>1000</u>	

This is allowed to mature for one month at least and is then added to other perfumes up to 5 or 10 per cent. To these it imparts an inimitable *cachet*.

An absolute is now prepared by the leading Grasse houses and is known as *Immortel*. The flowers are first extracted with petroleum ether or benzene which yields about 1 per cent of concrete. To alcohol this gives 85 per cent of absolute which is a thick and powerfully odorous liquid. The perfume content of this is 6.35 per cent. The decolorised absolute is yellowish in colour and has a much cleaner type of odour.

Evernia—see Oakmoss.

Exaltolide is the lactone of 14 oxy-4 decane-1 carbonic acid. It is a white crystalline solid having a powerful odour of musky character. As an expensive rarity it has been known for some years, but its commercial synthesis on an economic basis has recently been discovered by M. Stoll in the laboratories of Naef & Co. Exaltolide may be employed in all high-grade perfumes and compounds for powders, creams, lotions, etc. It imparts a distinctive elegance to these products which becomes evident some 20 days after perfuming.

Exaltone is the name given to commercially produced muskone—*which see*.

Expression is the process by which many of the *Citrus* oils are produced. It may be by hand when it is known as the "sponge process," or by mechanical means. For full details concerning these processes consult Volume II.

Farnesol, $C_{15}H_{26}O$, is a sesquiterpene alcohol occurring in ambrette seed oil and cassie, rose, Ceylon citronella, neroli, and cananga flower oils. It has a faint odour reminiscent of methyl ionone, but this has varied somewhat in three samples of continental origin which have been examined by the author. The peculiar honey-like fragrance of Bulgarian rose otto has been attributed to farnesol, but on the addition of this product to artificial rose oils of good blend no reproduction of this characteristic has been observed. It has not a wide application in perfumery, but its odour would suggest its usefulness for blending in sweet floral perfumes and Oriental bouquets. The chemistry of farnesol has been fully investigated by M. Kerschbaum.¹ S.G., 0.890; B.P., 160° C. at 10 mm.

Fatty Acids in perfumery are a most important group of materials, from which the corresponding alcohols are prepared by reduction. Those having even numbers of carbon atoms from 6 to 16 are derived from coco-nut oil while those with odd numbers from 7 to 11 are obtained from castor oil. The latter substance is also responsible for the first step in the synthesis of such well-established synthetics as *a*-amyl cinnamic aldehyde, gamma undecalactone and methyl heptene carbonate.

Fennel Oil.—Two oils are met with in commerce—the sweet and the bitter—the former being of most interest to the perfumer. It is distilled from either *Fœniculum dulce*, D.C., or *F. sativum*, N.O. Umbelliferæ, plants found on the shores of the Mediterranean and cultivated in Saxony, Moravia, France, Russia, India, etc. The oil has a sweet, delicate aroma resembling aniseed, and like the latter oil contains anethol (about 60 per cent) together with fenchone. It does not appear to be much used in perfumery but finds occasional employment in soaps of the fern type. The crushed fruits yield from 4 to 5 per cent of oil.

Fenugreek Seeds are the product of *Trigonella Fœnum-Græcum*, L., an annual herb belonging to the

¹ "Bulletin" of Roure-Bertrand Fils (April, 1914), 103.

N.O. Leguminosæ and largely cultivated in India, Egypt, Morocco, Arabia, Persia, and Greece. They are contained in long, narrow, cultivated pods from which they are removed by threshing when ripe and dried. They possess a characteristic odour and unpleasant taste, but are one of the usual constituents of cattle cake. The seeds contain about 6 per cent of fixed oil, but to steam distillation yield 0·014 per cent of volatile oil, having a brown colour and intense odour. The smell closely resembles that of β -methyl umbelliferone ethyl ether, a synthetic substance of the alloxy coumarin series.¹ It is of the type cellery-opoponax and of a peculiar mustiness. The seeds are extracted with petroleum ether and the subsequent product decolorised. In minute traces it may be used in aldehydic perfumes, and was, in fact, the secret note of a very successful French perfume.

Fern—see the account in Volume II.

Ferric Oxides—see Pigments.

Ferula Sumbul—see Sumbul Oil.

Fixatives may be divided into four classes :—

1. Animal.
2. Balsams, gums, and oleo-resins.
3. Essential oils of low volatility.
4. Synthetic aromatic chemicals.

They are added to perfume mixtures for the purpose of retarding evaporation and so, when artistically employed, they render in use a bouquet of persistent and unchanging fragrance. A complete account of this subject is given in Volume II. on Fixation, together with formulæ for artificial fixatives, ambers, etc.

Fixol is a name given to hydroxy-citronellal, of high boiling-point, about 275° C.

Florida Water—see Volume II.

¹ St. Pfau, "Riechstoffindustrie" (April, 1935), p. 57.

Fœnugreek—*see* Fœnugreek.

Foin Coupé, or new-mown hay perfumes, are mixtures of coumarin, lavender, or bergamot, with traces of oakmoss resin, clary sage oil, and synthetics added to round off the bouquet (*see* the monograph on New-mown Hay in Volume II.).

Fougère perfumes are generally based upon oakmoss and lavender and are similar to chypre, excepting that they are lighter. The ferns are dealt with in a separate monograph in Volume II.

Fragarol—*see* β -Naphthol-butyl Ether.

Frangipanni is the name given to a perfume which was popular up to the middle of the nineteenth century but is not often asked for to-day. The origin of the bouquet is interesting and a few details will therefore be given. Literally the name means "broken bread" and is derived from the Latin *frango*, to break, and *panis*, bread. It is the ancestral name of an ancient Roman family, and has been traced to one who held an important office in the church, *i.e.* that of breaking the bread in the Holy Sacrament. A descendant of the family, the Marquis Frangipanni, invented the method of perfuming gloves, and it is curious to note that subsequently the trades of the perfumer and glover became one. In later years the skins were perfumed in Spain and Italy and then made into gloves, purses, etc., in France. This gave rise to the name "Peau d'Espagne," but the two perfumes were quite different, and owing to the somewhat strong nature of the latter it soon fell into disuse. There appears to be no record of the exact constituents of the perfume used in the production of *Frangipanni gloves*, but when the perfume entered the market as a separate entity it was in the form of a sachet. According to Piesse¹ it was composed of every known spice, in equal proportions, to which was added powdered orris root, in equal weight to the whole, with 1 per cent of musk and civet. A liquid of the same

¹ "The Art of Perfumery" (1879), 13.

name was invented by the grandson, Mercutio Frangipanni, which he prepared by digesting the powder in alcohol. This, says Piesse, had the merit of being the most lasting perfume made. In more recent years the Frangipanni of every perfumer possessed a different bouquet, but the jasmin note certainly seemed to predominate in many of them. A formula of an artificial imitation is appended, and this will serve as a useful basis for experiment :—

300	Jasmin extra synthetic.
100	Lilac synthetic.
80	Muguet synthetic.
200	Rose centifolia synthetic.
200	Orange blossom synthetic.
10	Olibanum R.
30	Benzoin R.
10	Vetivert—Java.
20	Orris resin.
20	Coumarin.
30	Musk ketone.

1000

Frangipanni is also the name given by French Colonists in the West Indies to different species of the genus *Plumieria*. This genus was named by Tournefort in honour of Charles Plumier, a Franciscan traveller in South America. The principal fragrant species of *Plumieria* are *P. rubra* and *P. alba*, Jacquin., shrubs belonging to the N.O. Apocynacæ, bearing delightfully perfumed flowers which have an odour reminiscent of jasmin.

Frankincense—see Olibanum.

Freesia is botanically a genus of plants belonging to the N.O. Iridacæ and containing three species, all natives of South Africa. They grow from a corm, which sends up a tuft of long narrow leaves and a slightly branched stem bearing a few leaves and loose, one-sided spikes of fragrant funnel-shaped flowers. Several varieties are cultivated, amongst which *Freesia refracta* is perhaps one of the most popular. This was introduced into Europe in 1883. The colour of the flowers varies from white

to cream or yellow and they appear from March to the end of May. The majority of these grown for the market come from Guernsey. The garden flower is very popular in both England and America. The perfume of freesia is much appreciated and is generally of the sweet honey type ; in some varieties it is almost fruity (like plum jam, says F. A. Hampton). Freesias cannot always be said to emit a fragrance, however, because sometimes a whole bed will be almost odourless. In 1912 Messrs. Roure-Bertrand Fils attempted to extract the perfume of this flower but were unsuccessful both with volatile solvents and with enfleurage. *Lapeyrousia stenoloba*, another iridaceæ, has an odour like some Freesias. In practical perfumery every make of Freesia perfume differs : some are based upon vetivert and santal and others of the heavy narcissus type.

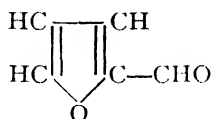
A typical Freesia perfume may be compounded as follows :—

250	Bergamot oil.
100	Lemon oil.
150	Petitgrain citronnier oil.
45	Ylang oil—Manilla.
10	Iso-butyl phenylacetate.
70	Phenylethyl alcohol.
20	Methyl ionone.
30	Hydroxy citronellal.
10	Eugenol.
5	Orris absolute.
10	Civet absolute.
100	Rose rouge.
30	Jacinthe artificial.
50	Jasmin absolute.
20	Rose absolute.
20	Jonquille absolute.
10	Orange blossom absolute
5	Cassie absolute.
5	Tuberose absolute.
20	Heliotropin.
5	Coumarin.
30	Musk ketone.
5	Vetivenyl acetate.

1000

Fumigating Pastilles—see Volume II.

Furfural is an odorous oily liquid boiling at 160° (742 mm.) and having a specific gravity of 1.1594. It has been identified in the essential oils or aqueous distillates of ambrette, clove, cinnamon, cypress, caraway, lavender, orris, petitgrain, W.I. sandalwood, vetivert, and ylang. This aldehyde is not believed to occur naturally, but to be due to the action of heat and acid on the carbohydrates present in the raw material. Furfural has the formula



Fusanus Spicatus—see Sandalwood Oil.

Galangal Oil—see Alpinia Oils.

Galbanum is a gum-resin obtained from *Ferula galbaniflua*, Boiss., and other species, N.O. Umbelliferae, plants indigenous to Persia. There are two varieties, Levant and Persian, but the latter, which is soft, is seldom met with in commerce. The former occurs in tears or masses of agglutinated tears, and yields about 10 per cent of volatile oil, which has a sharp, penetrating odour. The resin has a somewhat peculiar odour, musky and balsamic but not unpleasant. A strong alcoholic extract, prepared as described under benzoin, is useful in combination with traces of ammoniacum R. and large quantities of bissabol as a basis for opopanax perfumes.¹ Alone it makes an excellent fixative for mignonette and fern soaps.

Galls occur as excrescences on the branches of dyer's oak, *Quercus infectoria*, Olivier, a tree belonging to the N.O. Cupuliferae and distributed throughout Persia and Asia Minor. They result from the deposition of eggs by

¹ For a complete account of this drug consult the article by the author in the "American Perfumer," June (1924), 201.

an insect, and during growth feed on the plant tissues which sets up an irritation causing the formation of the galls. They contain gallotannic acid and were at one time much used in the preparation of hair dyes. In modern practice pyrogallic acid replaces them with advantage.

Gamma Nonyl Lactone is an oily liquid having a powerful odour reminiscent of coco-nut. It is useful in fancy perfumes of the gardenia and tuberose types. *Compare* Nonyl Lactone.

Gamma Undecalactone is the organic body familiarly known as aldehyde C₁₄. It has a fine odour of peaches and is much used for giving a sweet fruity note to perfumes. *Compare* Undecalactone.

Gardenia, as generally grown in this country, is the flower of *Gardenia florida*, L., a shrub belonging to the N.O. Rubiaceæ and native to tropical Asia and South Africa. The genus consists of numerous species, all of which bear beautiful and highly perfumed flowers. Among these may be mentioned *G. grandiflora*, *G. coronaria*, *G. radicans*, and *G. citriodora*. The odour of the latter recalls that of orange blossom while the others are reminiscent of jasmine. *G. florida* is known as Cape Jessamine. It is used in China for scenting teas. Guido Mariotti, an Italian professor, has recently been experimenting with the hybridisation of gardenias and has succeeded in producing thirteen coloured and scented specimens *shaped like roses*. The chemistry of gardenia has been investigated by E. Parone.¹ He treated 250 kilos of fresh flowers by maceration in liquid vaseline oil and shook out the essential oil with absolute alcohol, obtaining a yield of 176 grams having a yellowish colour. He identified the following constituents: benzyl acetate, styrolyl acetate, linalol, linalyl acetate, terpeneol and methyl anthranilate, together with

¹ "Boll. Chim. Farm.," 41 (1902), 489, through "Year Book of Pharmacy" (1903), 85.

traces of benzoic acid as ester. Although the chief constituent was benzyl acetate, the characteristic odour was due to styrolyl acetate. A complete account of this flower and its synthetic reproduction will be found in Volume II.

Gardeniol I. is phenylglycol acetate, known also as styrolyl acetate (*which see*).

Gardeniol II. is phenylmethyl carbonyl acetate (*which see*).

Gaultheria Oil is distilled from the leaves of *Gaultheria procumbens*, L., N.O. Ericaceæ, a plant growing in Canada and the United States, and known there as "tea berry." The methods of distillation are not quite as up-to-date as might be expected, and often comparatively crude stills are used. One of the principal producing centres is Monroe County, Pa., and an interesting account of the industry appeared in a leading American paper.¹ There are about sixty stills, spread over an area of some 200 square miles. Some of these are of permanent construction, others are itinerant, being moved from place to place as the raw materials are exhausted. The leaves are harvested from the early part of April to September. Those grown in the summer and collected before the fall afford the best material. The leaves are placed in the still and covered with water overnight at a temperature of 49° C. to induce the hydrolysis of the glucoside *gaultherine*.

The actual distillation requires about five to six hours, 90 per cent of the oil passing over into the condenser in the first three hours. This constitutes the first quality product, the yield being about 0.7 per cent. The genuine oil is at present practically unobtainable, but an almost identical product, the oil distilled from the bark of *Betula lenta*, L., N.O. Betulaceæ, is offered commercially as wintergreen oil. Methyl salicylate is the principal constituent. The oil is used in medicine, and to some extent in perfumery as a component part of synthetic cassie and

¹ "American Perfumer," 5 (1910), 192.

foin coupé. It also finds employment in soaps. Oils are also distilled from *G. fragrantissima* and *G. leucocarpa*, and in India are said to be used as a perfume for the purpose of scenting the garments of Indian princes.

Genêt—*see* Broom.

Geranaldehyde—*see* Citral.

Geraniol, $C_{10}H_{17}OH$, is a colourless liquid having a sweet delicate odour of rose type. It is widely distributed in nature, occurring sometimes in the free state and sometimes as ester. Amongst the volatile oils containing this alcohol, which is isomeric with linalol, may be mentioned rose, champaca, ginger-grass, geranium, Mexican linaloe, palmarosa, and citronella. Commercially it is worked up from the two latter oils, and small quantities are also separated from geranium oil but this is prone to contain citronellol as well. The odour of the product from the three sources differs noticeably, and in the case of citronella often contains traces of citronellal. This spoils the freshness of the odour and is removed in converting "technical" into "pure" geraniol. It is separated from Java citronella oil by fractional distillation under reduced pressure; in the case of the Ceylon oil, the usual practice is to remove the citronellal by combination with sodium bisulphite before distillation. The esters are saponified by treatment with alcoholic solutions of sodium hydroxide. On oxidation, geraniol yields citral. That from palmarosa oil is preferred to that from citronella oil. As a rule geraniols are sold as to the following qualities:—

- No. 1 from Palmarosa ;
- No. 2 „ Java citronella ;
- No. 3 „ Ceylon citronella.

Geraniol is extensively employed as the basis of all kinds of artificial floral oils—rose being a notable example. The following formula will illustrate its use in a rose for perfuming cosmetic creams:—

400	Geraniol palmarosa.
200	Dimethyl octanol B.
100	Phenylethyl alcohol.
100	Guaic-wood oil.
50	Geranyl acetate.
50	Alpha ionone.
30	Rose otto—Bulgarian.
20	Patchouli oil.
50	Musk xylene.
<u>1000</u>	

Geraniol is also much employed in combination with phenylethyl alcohol as the basis of rose compounds for soaps. The pure product has a specific gravity of 0.886 and boiling-point of 230° C.

Geranium Oil is a colourless to yellowish-green liquid obtained by distillation from various species of *Pelargonium*, a herb of the N.O. Geraniaceæ. It is not present in the flowers but has been shown by Charabot and Laloue¹ to occur principally in the leaves. The plants are extensively cultivated in Northern Africa, Southern France, Spain, Réunion, Kenya, Italy, and Corsica. They are probably varieties of the following species :—

- P. graveolens*, Ait. *P. capitatum*, Ait.
P. odoratissimum, Ait.
P. roseum, Willd. (a variety of *P. radula*, Ait).
P. fragrans, Willd. (a hybrid of *P. odoratissimum* and
P. exstipulatum, L'Hérit).

In Algiers there are at present about 2000 hectares devoted to the cultivation of geranium, whereas ten years ago the area was nearly three times as large. Practically all the oil is produced in the Mititja plain which lies some 15 miles south of Algiers. This is 60 miles long by 15 miles wide and runs almost parallel with the coast.

The plant appears to have been brought from France about 1850, where it had been cultivated in the neighbourhood of Grasse for some 50 years previously. The first

¹ "Comptes Rendus," 136 (1903), 1467.

Algerian plantations were in the regions of Cheragas and Chebli, later being extended to the Mititja plain. Cultivation is in the hands of about 150 farmers who grow the plants on their own ground and also distil the oil. According to Dr. E. S. Guenther,¹ who recently visited this district, the distillation apparatus is quite up to date, and consists of one or several batteries of steam stills, their number depending upon the size of the farmers' geranium fields. The principal centres of the industry are now situated at Boufarik and Blida. The farmers dispose of the oil to the co-operative, who are not distillers, but bulk the oil and keep it for some time in order to improve the odour. During a visit to this district in 1939, the author was able to confirm the up-to-date methods of both growing and distilling this oil.

The geranium distilled in Algeria is *Pelargonium graveolens*, Ait., and the oil develops in the green part of the plant, particularly the leaves. It is a perennial and yields oil for about seven years. The plants are propagated by cuttings and attain a height of about 3 feet. They are transplanted to light chalky gravel soil, clay does not yield so much oil. The harvest is carried out mainly by natives and there are two cuttings per annum. The first from April to June; the second from October to November. A special cutting for young plants may extend from April to July. The first crop is collected only after the leaves have begun to turn yellow—this synchronises with the change in odour from that of lemon to rose. The cut plants are taken to the distilleries and left to dry and ferment for 24 hours, thus increasing the yield of oil. According to Guenther one pound of oil is obtained from 1000 pounds of spring herb or from 800 pounds of autumn herb. The yield per hectare is as follows: 1st year—10 kilos; 2nd and 3rd year—30 to 35 kilos; 4th year—25 to 28 kilos; 5th year—20 to 25 kilos; 6th year—15 to 20 kilos; and 7th year—6 to 10 kilos.

¹ "American Perfumer," November (1931), 477.



FIG. 12.—A field of French Geranium at L'Abadie.

{*Antoine Chirris,*

{*To face page 188.*



FIG. 13.—Algerian Geranium on the Chiris Farms at Boularik.

[W. A. P.]

To face page 189.

The principal constituents of the oil are geraniol (total alcohols about 75 per cent) and geranyl tiglate. The usual adulterants are the residues from the production of concentrated oils, acetylated citronella and citronella residues. Algerian pelargonium plants are often attacked by parasitic species of *Cuscuta* (N.O. Convolvulaceæ) and *Orobanche* (N.O. Scrophulariaceæ).

In Southern France the plants are propagated by cuttings which must be renewed annually since they are killed by frost. They are wintered under suitable protection and transplanted out of doors during the early spring. The crop is collected in August and September, and on very rare occasions again in October or November. The plants are mown as soon as the leaves lose their lustre, preferably towards evening on fine days, so that the herb remains moist. Distillation is of course on the most modern lines, the yield being about 1 kilo of oil from 1700 kilos of herb.

In Réunion the pelargonium plants are cultivated at altitudes of about 2000 feet, and there are estimated to be over 300 stills in operation. These are of the false-bottom type and simple in construction. The crops are gathered throughout the year. When the plants are cultivated for several years, they are cut down more than if renewed annually. In order not to uproot them, shears are used for cutting the first year and then sickles. To prevent loss of oil by fermentation the cut herb is distilled immediately. The yield is about 30 to 50 kilos per hectare.

In Kenya large areas of geraniums are under cultivation, the industry having been founded in 1925 by Messrs. Dawson & Greene. The oil is of fine quality and readily sells in competition with French Colonial oils.

Geranium oils are also distilled in Spain, Corsica, and Italy.

During the last few years experimental cultivation of geranium (*P. odoratissimum*) in Florida, Texas, and California has been described by a well-known American

perfumery paper.¹ It would appear, however, that this crop cannot be successfully grown in regions where freezing temperatures occur even occasionally. Oils distilled from plants grown in these localities were found to be of excellent quality.

Geranium oils from the different sources have marked differences in odour value—that obtained from plants grown in the Vallauris district of France being of very fine bouquet. Spanish oils and occasionally Algerian, approach it in fragrance. They are sometimes described as having a slight musky note.

Geranium Sur Rose is prepared in the south of France by distilling 10 kilos of French geranium oil with 500 kilos of rose petals, the yield being just over 8 kilos of an oil having a very fine odour suitable for perfumery.

The principal constituents of geranium oil are geraniol and citronellol, together with small quantities of linalol, terpineol, phenylethyl alcohol, menthol and probably borneol and an amyl alcohol. Traces of the following have also been found: citral, *l*-menthone, tiglic, valerianic, acetic and butyric acids, pinene, phellandrene and dimethyl sulphide. Fractional distillation of the Réunion oil yields the **Rhodinol** of commerce.

Geranium oils are very widely employed for perfuming all kinds of toilet preparations, and they are invaluable for blending in numerous floral bouquets. No well-perfumed soap of good quality is complete without a liberal quota of this raw material. Terpeneless geranium oil is an excellent base for artificial rose ottos. The uses of geranium oils are so well known that illustrations of their application are superfluous.

Geranyl Acetate, $C_{10}H_{17} \cdot OOC \cdot CH_3$, occurs naturally in many volatile oils, amongst which may be mentioned those of sassafras leaves, French lavender, lemon, neroli, Ceylon citronella, *Darwinia fascicularis*, *D. grandifolia*, and *Euca-*

¹ "American Perfumer," September (1923), 339; January (1932), 609; March (1932), 28.

lyptus macarthuri. The ester may be obtained artificially by heating together geraniol, acetic anhydride, and sodium acetate, but in commerce it seldom exceeds 95 per cent purity. Geranyl acetate is a sweet, fragrant liquid, having an odour which recalls a blend of rose and lavender. It is employed in certain types of synthetic rose otto and universally as a sweetening agent in perfumes of all types. In soaps such as rose, jasmin, and lavender it is invaluable and may be used in quite large percentages. S.G., 0.910; B.P., 243° C.

Geranyl Benzoate, $C_{10}H_{17} \cdot OOC \cdot C_6H_5$, is a liquid of sweet soft fragrance used as a modifier and fixator in perfumes of rose type.

Geranyl Butyrate, $C_{10}H_{17} \cdot OOC \cdot (CH_2)_2 \cdot CH_3$, probably occurs naturally in the essential oil of *Darwinia grandifolia*, but in commerce is obtained synthetically from geraniol and anhydrous butyric acid. It has a characteristic fruity, rosaceous odour, and in small quantities is used in compounding artificial rose ottos of special type. It is sometimes employed to cheapen Algerian geranium oil by admixture. S.G., 0.8924.

Geranyl Formate, $C_{10}H_{17} \cdot OOC \cdot H$, is a more valuable product than the butyrate, but has not yet been identified as a natural constituent in any volatile oil. It is synthesised from geraniol and formic acid (anhydrous), and is obtained when these two bodies are allowed to stand together at normal temperatures for eight days. Many commercial specimens do not contain more than 92 per cent of true ester. Geranyl formate possesses a sweet fresh rose leaf odour, which has been compared to that of guaiacwood. It enters the composition of many synthetic rose oils, where it should not exceed about 5 per cent, and is a necessary constituent of artificial neroli oil. Two and a half per cent added to terpeneless petitgrain oil will give a remarkably accurate representation of orange blossom oil. S.G., 0.924; B.P., 102° C. at 10 mm.

Geranyl Iso-Butyrate, $C_{10}H_{17} \cdot OOC \cdot CH \cdot (CH_3)_2$, is a liquid having an odour resembling its isomer but of a richer floral fragrance. Used in the rose type of perfume. S.G., 0.8965; B.P., $123^\circ C$.

Geranyl Methyl Acetic Lactone is a liquid having an intense cedar-violet type odour blended with civette.

Geranyl Phenylacetate, $C_{10}H_{17} \cdot OOC \cdot CH_2 \cdot C_6H_5$, is a liquid having a soft, sweet rosaceous fragrance. It is a useful modifier.

Geranyl Propionate, $C_{10}H_{17} \cdot OOC \cdot C_2H_5$, is a liquid of rose odour, and may be successfully employed as a component of perfumes intended for paraffin brilliantines. S.G., 0.903.

Geranyl Tiglate, $C_{10}H_{17} \cdot OOC \cdot C(CH_3) : CH \cdot CH_3$, is a liquid of typical geranium odour, and is very useful in the preparation of artificial rose ottos.

Geranyl Valerianate, $C_{10}H_{17} \cdot OOC \cdot C_4H_9$, occurs naturally in the oils of sassafras leaves and some *Angophora* species. It is a liquid, prepared artificially, and possessing a peculiar rose-like odour. It is used for modifying rose perfumes. S.G., 0.890.

Giant Hyssop Oil is obtained by distillation of the flowers of *Agastache pallidiflora*, Heller, Rydb., N.O. Labiatae, a plant growing abundantly on the Pacific Coast of North America. The flowers have an intensely fragrant odour; this recalls thyme before the buds expand, and a mixture of thyme and peppermint after blooming. The bruised leaves emit a similar odour. According to J. F. Couch¹ the flowers distilled in July and August yield from 0.155 to 0.163 per cent of oil—the best yield being obtained from fully expanded flowers. So far the oil does not appear to be a commercial article. It should not be confounded with Hyssop Oil (*which see*).

Gingelly Oil—see Sesame Oil.

¹ "Year Book of Pharmacy" (1922), 50.

Ginger-grass Oil is obtained by distillation from *Cymbopogon Martini*, Stapf., N.O. Graminaceæ, the process being conducted by natives in India. The grass is grown from the Afghan frontier to the bend in the Ganges, and from the sub-tropical zone of the Himalayas as far south as Madras and Bangalore. Very primitive stills are employed, and these are generally erected beside streams with the condenser submerged near the river bank. The oil is brownish-yellow in colour. In many respects it resembles palmarosa oil, and was at one time considered to be an oil of poorer quality, especially as it entered the market from Bombay, and in the same kind of container. Burkill, however, established the botanical source of this oil, and found that it was distilled from the sofia (= mediocre) variety of the so-called "rusa" grass. Ginger-grass oil has a pleasant aroma, and is used in cheap soaps. It is liable to adulteration with mineral oil, turpentine, and gurgun balsam oil. Geraniol is the chief constituent together with dihydrocuminic alcohol, phellandrene, limonene, dipentene, carvone, and an aldehyde having an odour reminiscent of heptaldehyde and citronellal. An example of the use of ginger-grass oil in soap perfumery is appended :—

150	Ginger-grass oil.
300	Palmarosa oil.
100	Clove oil.
50	Cassia oil.
200	Cedarwood oil.
100	Spike lavender oil.
50	Styrax.
50	Musk xylene.
<u>1000</u>	

An oil of a pale yellow colour, which does not darken on keeping and which closely resembles ginger-grass, has been obtained by Joseph and Whitfield¹ from *Cymbopogon nervatus*. This grass is known as "naal," and is widely distributed in the Sudan. The oil is obtained from the

¹ "Year Book of Pharmacy" (1922), 67.

inflorescences, and consists principally of perilla alcohol and limonene.

Ginger Lily has been cultivated experimentally in the United States¹ on account of its very fragrant odour which is reminiscent of that of tuberose and gardenia. The flowers only are perfumed. Botanically the plant is *Hedychium coronarium*, L., and belongs to the N.O. Scitaminæ. Providing the oil can be obtained commercially it may prove of value in perfumery.

Ginger Oil is obtained by distillation from the rhizomes of *Zingiber officinale*, Roscoe, plants belonging to the N.O. Scitaminæ and cultivated in Jamaica, Africa, India, Japan, China, etc. Propagation is effected by cutting the rhizomes into "fingers," each containing a bud, and then planting about 1 foot apart. The fields are laid out in the same way as potato fields, the tubers being buried 3 or 4 inches deep in the ridges. The plants grow quickly and flower in the autumn. When the aerial stems wither, the rhizomes are dug up, trimmed and cleaned. In some kinds of ginger the peel is removed and in others it is allowed to remain. After drying the rhizomes are ready for export. On distillation a yield of up to 3 per cent of volatile oil is obtained. This is a pale yellow liquid having the characteristic odour of ginger but entirely devoid of pungency. (The latter is due to *gingerol* which is an inodorous oily body.) The following constituents have been so far identified in the essential oil: citral, methylheptenone, nonylaldehyde, linalol, *d*-borneol, esters, a phenol and a sesquiterpene alcohol. The addition of this oil in traces to Oriental perfumes will give a peculiar effect which is unobtainable with any other material, the result obtained being extremely difficult to imitate.

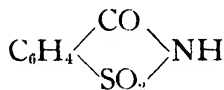
Giroflée is the wallflower (*which see*).

Glucose (Liquid) is a mixture of dextrose and other substances and is prepared by the hydrolysis of starch. It

¹ "American Perfumer," 13 (1918), 8.

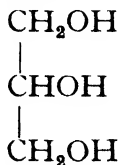
is used sometimes as an excipient in the manufacture of tooth pastes.

Gluside is a powder of intense sweetness, and is known also as 550 saccharine or benzoic sulphinide. The freely soluble form is much used as a sweetener in the preparation of tooth pastes, powders, etc., and is made by the addition of sodium bicarbonate to the above with the evolution of carbon dioxide. One hundred parts of 550 saccharine equal 113 parts of the soluble sodium compound. Gluside has the formula



The pure product melts at 220° C.

Glycerine is a clear, colourless, odourless, hygroscopic, syrupy liquid having a specific gravity of 1.260 and a sweet taste. It is one of the by-products in the manufacture of soap, being formed during the saponification of fixed oils and fats by alkali. It is also prepared by passing superheated steam into these substances, and is purified by re-distillation in silver-lined retorts. Glycerine is used in vanishing creams, hair creams, preparations for the hands and for the teeth (in the latter as an excipient). It is also occasionally used in the manufacture of toilet soaps, such as glycerine and cucumber, etc. Glycerine has the formula



Glyceryl Acetate, or acetin, is made by heating together glycerine and glacial acetic acid. It exists in three forms, the mono-, di- and tri-acetates. The latter in commerce frequently contains some of the other two. It is used as a solvent and has been employed as an adulterant of citrus and other essential oils.

Glyceryl Fumarate and other higher acyl derivatives of glycerine have recently been patented in the United States (No. 1497439) by Grunenberg and Katz, as substitutes for ethyl alcohol. They are inodorous liquids of high solvent power. An example of their use is given by the patentees :—

10	Rose synthetic.
40	Glyceryl fumarate.
60	Water.
60	Glycerine.
<hr/>	
170	

Glyceryl Mono Stearate is one of the newer substances having a certain vogue in the preparation of cosmetics. It is a waxy body melting at 57°C . When 10 to 15 per cent is heated with water to 70°C . until a homogeneous slime is produced, it forms an inseparable emulsion which cools down to a stiff cream but can be reheated without separation. The usual constituents of cosmetics, such as lanolin, alcohol, paraffin, glycerine, etc., can be incorporated, but electrolytes such as borax and salicylic acid should be avoided.

Glyceryl Oleostearate is a powder having the qualities of a cream and suitable for application to the skin for toilet purposes. According to the patent specification (No. 218154) of Walton and Tokalon it may be prepared from the following :—

Dairy cream	. . . . .	1000	grams
Olive oil	. . . . .	1000	„
Pancreatine	. . . . .	100	„
Stearic acid	. . . . .	10000	„
Potassium carbonate	. . . . .	500	„
Distilled water	. . . . .	50	litres

The cream, olive oil, and pancreatine are mixed and digested together at a temperature not exceeding 45°C . When digested it is strained through fine muslin. The potassium carbonate is dissolved in the distilled water at boiling-point and this is added to the melted stearic acid.

The two mixtures are now added together with rapid agitation until emulsification is complete. The glyceryl oleostearate is separated by aeration and rises to the surface as flocculent particles which are skimmed off. This is dried in an oven at 120° C. and when all moisture has been eliminated, is reduced to powder.

Glycine is the popular name for *Wistaria sinensis*, L., a climbing plant of the N.O. Leguminosæ, native of China, and commonly grown in gardens in this country. The mauve and white flowers bloom in early summer and take the form of pretty drooping racemes, and the perfume they exhale is faint, but somewhat honey-like. In extreme dilution methyl acetophenone resembles this odour. Glycine is also the name given to fancy bouquets made from violet, lilac, and jasmin compounds. A formula for an artificial glycine is appended :—

20	Methyl acetophenone.
130	Anisic aldehyde.
150	Terpineol.
100	Rhodinol.
100	Hydroxy citronellal.
80	Ylang-ylang—Bourbon.
70	Heliotropin.
150	Jasmin synthetic.
40	Orange blossom synthetic.
80	Rose synthetic.
30	Carnation synthetic.
50	Coumarin.
<hr/> 1000	

Glyco Stearin—see Diglycol Stearate.

Gorse is a prickly shrub common to the countryside of Britain. It flowers early in the year and its yellow inflorescence exhales a pleasant honey-like fragrance. Botanically it is *Ulex europæus* and belongs to the family Leguminosæ. Perfumes of this name are not common and are generally the product of the perfumer's imagination.

Goshtam—see Costus.

Grains of Paradise are the seeds of *Amomum melegueta*, Roscoe, plants belonging to the N.O. Scitaminæ and indigenous to West Africa. They possess an aromatic pepper-like odour and contain about 0.3 per cent of a yellowish, pungent essential oil. Grains of paradise are used in the manufacture of certain types of incense.

Grapefruit Oil is obtained by expressions from the fresh peel of *Citrus Decumana*, L., trees of the N.O. Rutaceæ grown principally in Florida. It is an amber-coloured liquid having a sweet pleasant odour reminiscent of a very fine Portugal, possibly with suggestions of lemon. The oil will deposit a flocculent precipitate on standing which disappears on warming. Grapefruit oil was first produced on a commercial scale in 1933, and in Florida two methods of removing the peel are practised prior to canning the fruit. The first in use consisted of cutting the peel off with a sharp knife and is known as the cold process, in contradistinction to the second and more commonly employed system of passing the fruit through a water-bath at just below boiling-point when the skins swell and are easily removed. Hand and machine pressing of the peel is practised, the latter being more often by the Pipkin process (see U.S. patent 1798555). The chemistry of the oil has recently been investigated by Nelson and Mottern,¹ who found it to contain approximately 90 per cent of limonene, 2 to 3 per cent of oxygenated, volatile constituents and sesquiterpenes, and 7 to 8 per cent of non-volatile, waxy materials. In the terpene-free oil, the following constituents were identified: octyl and decyl aldehydes, geraniol and octyl alcohol (both free and as acetates), cadinene and small quantities of citral and methyl anthranilate. Analysis failed to show any differences between oils from hot peel and from cold peel.

These chemists experimented with the preparation of terpeneless grapefruit oil, the most successful method consisting of the removal of the limonene, extraction of the

¹ "American Perfumer," April (1934), 71.

light boiling aldehydes from this and adding them to the oil obtained by steam distillation of the residue, freed from most of its limonene, this distillation being carried out in a special apparatus.

Grapefruit oil is used largely in the flavouring industry but offers promise in perfumery. The author found it acceptable in colognes and other perfumes where orange and lemon oils are employed.

Grape Seed Oil was first produced about 1900 in Southern France as a substitute for olive oil. To-day this industry is almost exclusively in the hands of the Californian Products Company at Fresno, California, where between 2000 and 4000 tons of seeds are worked annually. These seeds are a waste product of the raisin industry and the most up-to-date methods of oil manufacture are employed. The seeds are removed mechanically from the Muscat raisins and then washed to remove adherent pulp. The pulp, having a sugar value, is fermented and distilled into high-proof brandy spirits. The seeds are dried, ground, pre-heated, and hydraulically pressed, the oil being subsequently settled, refined, bleached, and winterised. The yield is about 17 per cent.

The inodorous, tasteless, and colourless qualities of grape seed oil soon attracted chemists in the cosmetic industry and it now forms a useful and much appreciated ingredient of face creams, etc. Samples examined by the author kept fairly well, but the use of some anti-oxidant is desirable. So far as is known it has no allergic effect upon the skin, and since it contains over 50 per cent of linoleic acid, might prove a useful source for the so-called vitamin F.

Grass Oils—see Palmarosa, Ginger-grass, Lemon-grass, and Citronella.

Guaiacwood Oil, also known as champaca-wood oil, is distilled from *Bulnesia Sarmienti*, Lor., N.O. Zygophyllaceæ, a lofty tree growing in the Argentine. The wood enters

commerce as Palo balsam, and when exposed to the air, develops a greenish-blue colour due to the presence of guaiac resin. On distillation this yields about 5 per cent of oil which is solid at ordinary temperatures and melts about 45° C. It has a delicate odour recalling tea roses, and is used for blending with other oils in the production of rose and violet compounds where it acts as an excellent fixative. Guaiac oil has been found as an adulterant of otto of roses and of santalwood oil. It has also a very effective application as a delicate soap perfume, and as such is very stable. Almost all sweet odours benefit by its addition. For instance in violet soap compounds it may be employed thus :—

300	Ionone.
200	Cedarwood oil.
100	Guaiacwood oil.
50	Clove oil.
100	Palmarosa oil.
100	Benzyl acetate.
70	Orris oleo-resin.
25	Vetivert oil.
5	Vanillin.
50	Musk xylene.
<u>1000</u>	

Guaiol is a sesquiterpene alcohol of the formula $C_{15}H_{26}O$ and melts at 91° C. It is a constituent of guaiacwood oil but has no specific use in perfumery.

Guaiyl Acetate is a somewhat viscous oil having an odour of tea roses. It is used in the preparation of this perfume, but its characters lend themselves to experiment with this body in lily and cyclamen compounds.

Guaiyl Phenylacetate is an oil having a sweet honey-rose odour. It is a useful modifier.

Gurjun Balsam is an oleo-resinous secretion from different species of *Dipterocarpus* trees indigenous to India, China, and the East. It is very much like copaiba balsam

and is used as an adulterant of essential oils (*e.g.* palmarosa).

Hæmatoxylin—*see under* Logwood.

Hair Dyes—*see* Volume II.

Hamamelis.—The only preparation of this plant used in cosmetics is obtained by distilling the leaves of *Hamamelis virginiana*, L., N.O. Hamamelidaceæ, and known in pharmacy as Liquor Hamamelidis Dest. It is a colourless liquid of characteristic odour, containing about 17 per cent of alcohol added as a preservative. It is used up to 50 per cent in stearic acid creams of the witch hazel snow type (*see* Vol. II.), and as an astringent in skin lotions of all kinds.

Hard Soap—*see* Castile Soap.

Hardwickia Balsam—*see* African Copaiba Oil.

Hawthorn, or May blossom (*Crataegus oxyantha*), is a well-known hedge tree belonging to the N.O. Rosaceæ, and is a native of most parts of Northern Europe and Asia. The myrtle-like blossoms have an exquisite fragrance, which is recalled by anisic aldehyde. This is the base of all perfumes of this type and the odour is rounded off with acetophenone and rose. For further details and formulæ, see the monograph on the subject in Volume II.

Hayfields.—*Foin coupé* perfumes are based upon coumarin in combination with the terpeneless oils of bergamot and lavender, the odour being rounded off with methyl salicylate, clary sage oil, and oakmoss resin. The two plants which contribute largely to the odour of the hayfields are *Alyssum compactum* (sweet alyssum) and *Anthriscus odoratum* (sweet-scented vernal grass). The sweet woodruff is also delightfully fragrant. For further details, see monograph on New-mown Hay in Volume II.

Helichryse Oils—*see* Everlasting Flower Oil.

Heliotrope—*see* the monograph in Volume II.

Heliotrope Concrete is a mixture of aromatic substances, warmed together and allowed to solidify as follows :—

600	Heliotropin.
100	Vanillin.
100	Cinnamic alcohol.
40	Acetyl iso-eugenol.
60	Anisic alcohol.
100	Benzyl salicylate.
<u>1000</u>	

Add some stearic acid if necessary.

Heliotropin-Amorphous is a mixture of synthetics on the following lines :—

450	Heliotropin.
50	Vanillin.
200	Benzoic acid.
300	Anisic acid.
<u>1000</u>	

Powder and mix well.

Heliotropin (Piperonal), $\text{CH}_2 \cdot \text{O}_2 \cdot \text{C}_6\text{H}_3 \cdot \text{CHO}$, is a white or yellowish-white crystalline body having the delightful odour of cherry pie. It is artificially prepared by the oxidation of **iso-safrole**, but was originally obtained from pepper by the oxidation of piperic acid with potassium permanganate in alkaline solution. Heliotropin has been shown to occur in nature in the oils of *Spirea ulmaria*, *Robinia pseudo-acacia*, and probably also exists in several vanillas. This aldehyde is the methylene ether of protocatechuic aldehyde. Heliotropin melts at 36°C ., is indispensable as a base for heliotrope perfumes, and is one of the most popular modifiers in use. It is of distinct value in carnation and sweet-pea perfumes, while it blends well with anisic aldehyde, vanillin, musks, coumarin, benzyl iso-eugenol, and several essential oils, including bergamot, neroli, and rose. The only disadvantage it possesses is that of turning reddish-brown

on exposure to light for any period. This is a point which must not be lost sight of, as the employment of piperonal for perfuming white creams or lotions might be followed by disastrous results if packed in translucent containers and exposed to brilliant light. If the heliotrope odour is desired for such preparations, however, it can be imitated to some extent by vanillin and traces of benzaldehyde. Heliotropin is sometimes used as a soap perfume, but it is always preferable to colour the soap since on keeping, the tablets, if uncoloured, would develop brown patches. Heliotrope has recently become quite a favourite for perfuming cosmetics, especially amongst Continental manufacturers. The type of compound in use is as follows :—

400	Heliotropin.
50	Vanillin.
100	Rhodinol.
100	Phenylethyl alcohol.
100	Cinnamic alcohol.
20	Anisic alcohol.
70	Benzyl acetate.
50	Ylang-ylang—Bourbon.
30	Coumarin.
30	Alpha ionone.
50	Musk ketone.
<u>1000</u>	

This perfume base would have an approximate Point B of 18 and therefore about $\frac{1}{3}$ per cent should not be exceeded if safety from skin irritation is to be assured.

Heliotropin should be kept in a cool dark place, otherwise the odour value will deteriorate appreciably (see monograph on **Heliotrope** in Volume II. for further details).

Heliotropyl-Acetone, $\text{CH}_2 \cdot \text{O}_2 \cdot \text{C}_6\text{H}_3 \cdot \text{CH} : \text{CH} \cdot \text{CO} \cdot \text{CH}_3$, is a crystalline substance melting at 54°C . and having a sharp heliotrope odour.

Hemerocallis Flava, also known as day lily or yellow tuberose, is a beautiful flowering bulbous plant whose

yellow lily-like blossoms seldom last longer than one day. Fortunately there is a plentiful succession, so that the plant continues to exhale its pleasant perfume for a considerable time. *Hemerocallis* flowers are artificially prepared by mixing together in suitable proportions, linalol, cinnamic alcohol, amyl salicylate, rhodinol, and hydroxy-citronellal, with traces of clary sage oil.

Henna powder of commerce consists of the ground leaves of *Lawsonia inermis*, L., N.O. Lythraceæ, a thorny tree or shrub grown in Northern Africa, China, and India. It was much used by the Egyptians and Asiatics for dyeing the hair, finger-nails, etc., an orange hue. Very fine and well-preserved examples of this are to be found in the British Museum. Henna flowers are very fragrant and exhale an odour recalling lilac, although curiously enough in the West Indies the shrub is called *Jamaica Mignonette*. In Northern Africa the seedlings are raised in nurseries and transplanted in the spring, being placed in the fields about 2 feet apart. They are irrigated every week and flourish for about twelve years. The crop is collected twice a year, in February and August, when the plant is cut down just above the ground. The yield of dried leaves is about 16 cwt. per acre. The dyeing properties of henna are due to **Lawson** (2-hydroxyl, 4-naphthaquinone). According to the investigations of H. E. Cox,¹ whereas alkalis intensify the colour of aqueous solutions of lawson, they destroy its dyeing properties. Aqueous solutions of henna are normally acid, and to act effectively as a dye, lawson requires to be used in acid solution. In view of these observations it would seem that Lorol shampoos are the only really effective media for henna. A decoction of henna has recently come very much into vogue in shampoos, brilliantines, etc., and is extensively used for dyeing the hair a rich auburn tint. Consult also the chapter on Hair Dyes in Volume II.

Heptene Carbonate—see Methyl Heptene Carbonate.

¹ "Manufacturing Perfumer" (1938), 166 and 239.

Heptyl Acetate, $\text{CH}_3 \cdot \text{COOC}_7\text{H}_{15}$, is a liquid of fruity odour used in the preparation of fruit essences. S.G., 0.876; B.P., 186°C .

Heptyl Alcohol, $\text{CH}_3 \cdot \text{CH}(\text{OH}) \cdot \text{CH}_2 \cdot (\text{CH}_2)_3 \cdot \text{CH}_3$, or methyl-amyl-carbinol, is a liquid having a highly aromatic odour and has been identified as a constituent of clove oil. It is prepared artificially and may be used in carnation compounds. S.G., 0.832; B.P., 175°C .

Heptyl Aldehyde, $\text{CH}_3 \cdot (\text{CH}_2)_5 \cdot \text{CHO}$, is an oily liquid having a heavy fruity odour of great persistence, and although it is not much used in perfumery, mere traces of it will completely alter any compound to which it is added—0.1 per cent should seldom be exceeded. It is commonly called **œnanthic Aldehyde**, and was found by Kraft to be produced together with undecylenic acid when castor oil is subjected to distillation under reduced pressure—due to the decomposition of ricinoleic acid. This reaction is the first step in the synthesis of methyl heptene carbonate—*which see*. S.G., 0.8226; B.P., 153°C .

Heptyl Formate, $\text{H} \cdot \text{COOC}_7\text{H}_{15}$, is a liquid of fruity fragrance used in the preparations of artificial fruit essences. S.G., 0.884; B.P., 177°C .

Heptyl Heptoate, $\text{CH}_3 \cdot (\text{CH}_2)_5 \cdot \text{COOC}_7\text{H}_{15}$, is an oily liquid having similar properties and uses to aldehyde C_7 . It combines well with coumarin compounds.

Heptyl Propionate, $\text{C}_2\text{H}_5 \cdot \text{COOC}_7\text{H}_{15}$, is a liquid having an odour somewhat after the type of cinnamyl propionate excepting that it has a waxy nuance. It may be used for shading rose odours. S.G., 0.8846; B.P., 21°C .

Heptyl Valerianate, $\text{C}_4\text{H}_9 \cdot \text{COOC}_7\text{H}_{15}$, is a liquid, and possesses the most typical fruity odour of the series. Used in fruit essences.

Heptylidene Acetone, $\text{C}_8\text{H}_{13} \cdot \text{CH} : \text{CH} \cdot \text{CO} \cdot \text{CH}_3$, is an oil of fruity jasmin character. It is known also as œnanthylidene acetone.

Herrabol—*see* Myrrh.

Hexadecyl Aldehyde, (C_{16}) .— $CH_3 \cdot (CH_2)_{14} \cdot CHO$ in the pure state is an odourless substance, but in commerce this pseudo-aldehyde possesses a powerful odour recalling strawberries, and is used in traces to give a new note to many of the commoner floral bouquets. It is a mixture which owes its strawberry note to an ester—methyl phenyl glycidate of ethyl.

Hexahydrophenyl Benzoate and Phthalate are recently patented synthetics. They are odourless and colourless liquids employed as solvents for artificial musk.

Hexamine $(CH_2)_6N_4$, known also as Formin and Hexamethylene tetramine, is a white crystalline powder subliming at $263^\circ C$. without melting and with partial decomposition. It is prepared by the action of ammonia on formaldehyde. The addition of 0.05 per cent to a preparation will prevent fungoid growth and retard rancidity. Up to 5 per cent may be used as an anti-oxidant in deodorant creams, etc.

Hexyl Acetate.

Hexyl Alcohol, normal (and iso-),
 $CH_3 \cdot (CH_2)_4 \cdot CH_2OH$.

Hexylenic Aldehyde.

Hexyl Butyrate.

Hexyl Formate.

Hexyl Valerianate.

} These bodies have a fruity odour and have been identified in nature. They are now prepared artificially, but do not appear to have any use in perfumery other than in the modification of floral odours.

Hexyl Iso-Eugenol occurs as a white powder of balsamic odour. It is more pungent than benzyl isoeugenol and an effective ingredient in carnation compounds.

Hexyl Methyl Ketone, $C_6H_{13} \cdot CO \cdot CH_3$, is a pungent liquid whose odour recalls mignonette and also œillet. For obtaining a new note in either of these perfumes it is invaluable.

Homoheliotropin is a pale yellow liquid of heliotropin-like odour and is miscible with essential oils and synthetics, but on exposure is prone to resinify.

Homo-Linalyl Acetate, $C_{11}H_{18}.OOC.CH_3$, is prepared synthetically, and its odour resembles that of bergamot oil, to which has been added some lavender. It differs slightly from linalyl acetate, but in a general way is not so useful.

Homovanillin is a white crystalline substance melting at $50^{\circ}C.$, and having an agreeable floral odour which resembles vanilla more closely than vanillin.

Honey Compounds have a special application in certain perfumes and the note is obtained with para-methyl quinoline or other derivatives of quinoline in combination with phenylacetic acid and esters. They often appear on the market as **Miel**. Wax or **Cire** compounds are of similar composition excepting that the quinoline derivatives are used in lower percentages. A type example follows :—

100	Para-methyl quinoline.
120	Citronellol.
350	Phenylethyl alcohol.
80	Cinnamic alcohol.
100	Heliotropin.
50	Methyl phenylacetate.
200	Phenylacetic acid.
<u>1000</u>	

Honeysuckle, or Woodbine (*Lonicera Periclymenum*), is a twining shrub of the N.O. Caprifoliaceæ, attaining a considerable height on trees, and is a favourite for forming arbours and planting against houses. The flowers possess a delicious fragrance. Honeysuckle perfumes are not obtained from the flower, but are mixtures of rhodinol, benzyl acetate, linalol, methyl anthranilate, and heliotropin. For a complete account consult the detailed monograph in Volume II.

Ho Oil is the new name given to Shiu oil (*which see*). This change has been deemed desirable since the latter

name signifies "evil-smelling." Ho oil means "oil of sweet odour."

Hops—An oil is obtained by distillation of the female inflorescences and the lupulin of *Humulus lupulus*, L., N.O. Urticaceæ. According to Gildemeister and Hoffmann,¹ the yield from hops is up to 1 per cent while that from lupulin is up to 3 per cent. The strobiles are picked when fully developed and dried. Sometimes their colour is preserved by exposure to the fumes of burning sulphur. Oils distilled from hops so treated have an unpleasant odour. Hop oil has a greenish-yellow to reddish-brown colour and possesses the characteristic odour of the hop. The following constituents have so far been identified: dipentene, myrcene, linalool, humulene, free formic acid, heptylic acid, valeric acid, esterified formic acid, acetic, decylic, nonylic, octylic, ænanthylic, butyric, and probably iso-nonylic acids. It is used in the brewing and mineral water industry and occasionally in tobacco flavours.

Hormones are specific secretions of the endocrine glands—adrenal, gonadal, pancreatic, parathyroid, pineal, pituitary, thymic, and thyroid. They have definite, measurable multiple effects upon the human organism, and their chemical and physical characters have in some cases been determined. Many of them have been produced synthetically. They differ from vitamins in that they are elaborated within the human organism, which is believed to be connected with a balanced supply of the known vitamins to the body.

In late years hormones have received some attention and publicity for their supposed absorption by the skin when applied in the form of cosmetics, but since these complex substances are actually of direct medical importance, they should, in the author's opinion, be used only on the specific instructions of a duly qualified medical practitioner.

Huon Pine Oil is distilled from the wood of *Dacrydium*

¹ "The Volatile Oils," ii., 326.



FIG. 14.—Cultivated Hyacinths.

[Antonie Chiris.

[To face page 209.

Franklini, Hook, N.O. Taxaceæ, a tree attaining a height of about 100 feet and found mainly in Tasmania but also in New Zealand, the Malay Archipelago, etc. The tree yields excellent pine timber and from the shavings 5 per cent of oil is distilled. This consists largely of methyl eugenol (97.5 per cent) with traces of eugenol and cadinine. It is now available in commercial quantity and may be used advantageously in all preparations containing clove oil, which it will replace if not wholly, in part. An oil from the leaves of this tree has been prepared and consisted largely of terpenes (dacrydene, etc.).

Hyacinthal—*see* Hydratropa Aldehyde.

Hyacinthin is a name given to phenylacetic aldehyde.

Hyacinth Oil has been isolated from the flowers of *Hyacinthus orientalis*, L., N.O. Lilaceæ, but the perfume is usually extracted in the form of absolute or concrete. It is a dark greenish substance having a sharp penetrating odour which only assumes the fragrance of hyacinths on extreme dilution. The constitution of hyacinth has been elucidated by Messrs. Hoejenbos and Coppens,¹ who extracted flowers grown in the vicinity of Amersfoort, Holland, with benzine. A solid light brown concrete resulted which was dissolved in alcohol and the paraffins and waxes frozen out. The oil was steam distilled *in vacuo* and on analysis gave the following constituents: phenylethyl alcohol, eugenol, methyl eugenol, benzoic acid, benzyl acetate, benzyl benzoate, benzyl alcohol, cinnamic alcohol, cinnamyl acetate, benzaldehyde, cinnamic aldehyde, methyl *o*-methoxybenzoate, ethyl *o*-methoxybenzoate, methyl methylanthranilate, dimethyl hydroquinone and possibly also N-heptanol.

Phenylacetaldehyde and homologues, aliphatic aldehydes and alcohols and esters were not found.

The greater number of hyacinth oils on the market are

¹ "American Perfumer," June (1932), 210.

prepared artificially, with one or other of the following bodies as their base :—

Bromstyrole has a strong, crude hyacinth odour, and is used generally as a soap perfume.

Cinnamic Alcohol possesses a much milder and sweeter odour, and has distinct fixative qualities.

Phenylacetic Aldehyde is the most suitable article for fine perfumery, and its odour is smooth, sweet, and powerful.

Styrolyl Acetate possesses a sweet and delicate hyacinth-gardenia perfume, and is frequently used to blend with other oils where a suggestion only of the flower is required (as in Cyclamen, *which see*).

For further details and formulæ, reference should be made to the monograph on Hyacinth in Volume II.

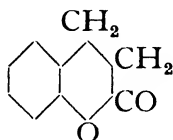
Hydratropa Aldehyde, $C_6H_5 \cdot CH(CH_3) \cdot CHO$, known also as *a*-phenyl propionaldehyde, is a colourless semi-viscous liquid of powerful, almost harsh, hyacinth type odour. It is remarkably stable and does not polymerise. Its principal use is in soaps of the type of hyacinth, lilac, and rose. Hydratropa aldehyde is known also as hyacinthal.

Hydrocinnamic Acid, $C_6H_5 \cdot CH_2 \cdot CH_2 \cdot COOH$, is a crystalline substance melting about $48^\circ C.$, and may be synthetically prepared by the reduction of cinnamic acid with sodium amalgam. It possesses a pleasant hyacinth-rose odour, and is useful for fixing this type of perfume.

Hydrocinnamic Aldehyde, $C_6H_5 \cdot CH_2 \cdot CH_2 \cdot CHO$ (phenyl propyl aldehyde), when freshly prepared, is a colourless liquid having a specific gravity of 1.018 and boiling-point of $222^\circ C.$ It has a powerful floral fragrance of hyacinth type and not unlike phenylacetic aldehyde. In nature it probably occurs as a constituent of Ceylon cinnamon oil. Hydrocinnamic aldehyde is prepared synthetically, is remarkably

stable, being uninfluenced by alkalis and consequently a valuable soap perfume. It blends well with red rose, jasmin, lily, lilac, ylang-ylang, sweet-pea, and carnation perfumes and also with coumarin and heliotropin. It is invaluable in combination with the heavier odours for the production of new Oriental bouquets.

Hydro Coumarin is an organic body having similar properties to those of coumarin. It has the formula



and is known as *melilotin*.

Hydrogen Peroxide, H_2O_2 , generally occurs in commerce in a 6 per cent solution, being equivalent to 20 volumes of available oxygen. It is a colourless liquid having a slightly acid taste and is generally artificially preserved. For many years substances such as citric acid, boric acid, hydrochloric acid, sodium pyrophosphate and acetanilide were employed for this purpose, but recently it has been shown that methyl *p*-hydroxybenzoate in 0.1 per cent strength will prevent the loss of oxygen up to a period of two years. Hydrogen peroxide is prepared by the action of sulphuric acid upon a suspension of barium peroxide in water at a temperature below 10°C . It is used in nail bleaches, skin bleaches, and peroxide creams. Peroxide tooth powders generally contain small quantities of magnesium peroxide.

Hydrogenated Oils have for some years been important raw materials in the manufacture of soap, and are now widely used in edible fats, such as margarine, and ultimately in biscuit manufacture, etc. Their use in cosmetics is at the present time also fairly general. They are made by the catalytic action of hydrogen on such oils as

castor, palm kernel, cotton seed, sesame, coco-nut, soya bean, ground nut, and various fish oils. The hardening resulting from this process is due to the conversion of the unsaturated glycerides, such as oleic acid, etc., to synthetic stearins, the liquid oils assuming the physical characters of a hard fat or stiffish but soft wax. The approximate melting-points in °C. are given for a few examples :—

Hardened castor oil	.	.	40/42 up to 84
„ coco-nut	.	.	28/36
„ cotton seed	.	.	30/32, 50/52 up to 60
„ ground nut	.	.	30/32, 40/42 „ 65
„ palm kernel	.	.	30/45
„ soya bean	.	.	30/32, 40/42 „ 67

The advantages accruing from their use in cosmetics is as follows :—

1. White, odourless, non-rancid and good texture.
2. Wide range of melting-points.
3. More stable than many of the expensive natural fixed oils and waxes.
4. Favourable price range.

Hydroquinaldine is an oil having an odour of lilac type—see Tetrahydro-2-methyl Quinoline.

***p*-Hydroxybenzoic Acid Esters** are the most efficient preservatives known to-day for cosmetics and pharmaceutical preparations. These new substances are a considerable advance over the principal preservatives hitherto in use, and are, in fact, of a less toxic nature than the widely used benzoic acid. They are white crystalline compounds and do not affect the smell, taste, colour or consistency of the material to be preserved. The growth-arresting action of the esters of *p*-hydroxybenzoic acid, $C_6H_4.OH.CO_2H$. (*ortho*-hydroxybenzoic acid is salicylic acid), on *staphylococcus pyogenes aureus* in artificial nutrient medium is indicated in the table below and is the work of Professor D. T. Sabalitschka.¹

¹ "Manufacturing Chemist," January (1931).

Taking the degree of activity of phenol as equal to unity, the following are the comparative figures :—

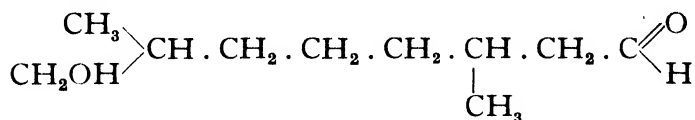
Phenol	1
<i>p</i> -Hydroxybenzoic acid methyl ester	3
" " ethyl "	8
" " propyl "	17
" " butyl "	32
" " iso-amyl "	50
" " benzyl "	109

Experiments with numerous other micro-organisms yielded corresponding results. These substances are sold under the trade names, nigapin, nipasol, nipabenzyl, etc., and the percentage to be used depends upon the esters chosen and the type of cosmetic being preserved.

It should be borne in mind that the function of these chemical compounds is to repress any development of micro-organisms present in the material treated and in the course of time to kill them. Also to preserve the material absolutely from micro-organisms (mycoderma, decomposition, putrefaction, fermentation, etc.), and finally to retard the rancidity evoked by micro-biological influence.

Hydroxy-Citronellal is a colourless viscous oil with a sweet, powerful odour recalling tilleul (lime or linden blossoms). To perfumers the synthesis of this body is probably the most remarkable discovery of recent years. It has made it possible to accurately reproduce the odour of muguet, and by the addition of traces to other floral ottos has assisted in imitating faithfully perfumes which had previously been comparatively crude. Furthermore, owing to its high boiling-point, it is a fixative of no mean order, and probably tops the list of synthetics of this class. The hydroxy-aldehydes are prepared by hydrating the corresponding unsaturated aldehydes—generally by treating the bisulphite compound with fairly concentrated sulphuric acid in the presence of an iron catalyst. Chemically this

substance is oxydihydro citronellal or citronellal hydrate. It has the following constitution :—



S.G., 0.955.

Hydroxy-citronellal may be used successfully in jasmin, lily, lilac, magnolia, and hyacinth flower oils. It is a useful modifier in all perfumes.

As an illustration of the value of hydroxy-citronellal *as a base* a formula for lily of the valley is appended :—

500	Hydroxy-citronellal.
150	Geraniol from palmarosa oil.
100	Ylang-ylang oil—Manilla.
100	Linalol.
50	Terpineol.
80	Benzyl acetate.
10	Jasmin absolute.
10	Civet absolute—10 per cent.
<u>1000</u>	

The following formula for lilac will show how it can be used *as a blender and fixer* :—

400	Terpineol.
200	Phenylethyl alcohol.
150	Heliotropin.
40	Musk ketone.
10	Methyl anthranilate.
200	Hydroxy-citronellal..
<u>1000</u>	

Hydroxy-citronellal is known under several names, such as muguetine principe, cyclalia, cyclosia, lily aldehyde, laurine, muguet synthetic, etc. Hydroxy-citronellal residues are very useful in soap perfumery and blend well with bromstyrole, linaloe, geranium, and palmarosa oils, benzyl acetate and coumarin.

Hypnone—*see* Acetophenone.

Hyraceum is the product of the hyrax, a species of the genus *Procavia* inhabiting parts of South Africa, Arabia, and Syria. The animals are small, brownish-grey and rabbit-like with short snout, ears and legs and a small tail. They live in the crevices of rocks and feed upon foliage and tree-shoots. Many are arboreal and expert climbers. Hyraceum is probably the faeces and urine of these animals. It occurs in irregular amorphous masses, plastic when kneaded in the fingers and exhibiting fibres and hairs when examined microscopically. The odour is somewhat musky and recalls that of castor. It is sometimes used as a substitute for the latter. The employment of hyraceum in fine perfumery is not recommended.

Hyssop Oil is obtained by distillation from *Hyssopus officinalis*, L., a herb belonging to the N.O. Labiatae and found growing wild in countries bordering the Mediterranean. The commercial oil is obtained generally from cultivated plants in Provence and to some extent also in Germany. The flowers, which appear from September to October, are aromatic and either a pale bluish-white or pink colour. The herb yields about 0.5 per cent of oil, which is used mainly as a flavour and to some extent in perfumery, e.g. eau de Cologne.

Ianthone, $C_{16}H_{24}O$, is a ketone of violet odour and may be prepared by condensing citral with mesityl oxide.

Illurin Balsam—see African Copaiba Oil.

Immortel Absolute—see Everlasting Flower Oil.

Incense—see Olibanum.

Incenso Macho is the name given in Peru to the hard reddish-black masses of resin probably exuded from *Styrax ovatum*, D.C., a plant of the family Styracæ. It is used as incense and in perfumery. The odour is reminiscent of Siam benzoin or vanilla and contains vanillin and benzoic acid.

Inchi Grass Oil—see Kachi Grass Oil.

Indole is a white crystalline body which melts at 52° C. and boils at 253° C., and on exposure to light and air soon assumes a reddish tint. It possesses a powerful and decidedly disagreeable odour, but in extreme dilution this acquires a distinct floral note of the orange blossom-jasmin type.

It has the formula $\text{C}_6\text{H}_4 \begin{array}{c} \text{CH} \\ \diagup \quad \diagdown \\ \text{NH} \end{array} \text{CH}$. Indole occurs

naturally in the oils of jasmin, neroli, orange blossom, robinia, wallflower, and some *citrus* species, and in the animal organism as a product of intestinal digestion. E. O. von Lippmann¹ has shown that it occurs, together with skatole, in the vapours given off when extracting sugar from molasses by the strontia method. It is synthetically prepared during the manufacture of indigo but may also be prepared from pyrrol. This substance, under certain conditions and in the presence of dilute sulphuric acid, condenses to tripyrrol, which then loses ammonia and passes into indole. A great difficulty in this process has been the economic production of pyrrol. This, however, appears to have been overcome, since when scrap leather is destructively distilled fairly large yields of pyrrol are obtained. Indole is used in the preparation of artificial jasmin and neroli oils.

According to Hesse and Muller, natural jasmin oil contains $2\frac{1}{2}$ per cent of indole, but in compounding synthetic jasmin 1 per cent is sufficient, providing the otto contains about 10 per cent of jasmin natural concrete. Two per cent may be used in cheaper floral ottos, but the perfume becomes objectionable after slight evaporation. In order to overcome this difficulty, phenylacetic acid has been recommended in place of indole, but the resulting oil is not so true to the odour of the flower. Indole when mixed with other synthetics and exposed to light rapidly becomes reddish-brown in colour, and should not be used for perfuming white toilet articles on this account. The presence of indole in flowers can be demonstrated by the following simple experiment. Take a covered glass vessel and in

¹ Schimmel & Co., "Report" (1916), 135.

the bottom place a layer of cotton wool previously soaked in a saturated solution of oxalic acid. On this place a large watch glass containing the flowers. In twenty-four hours, if indole is present, a violet-red coloration appears on the wool.

Inula—see Elecampane.

Ionone, $C_{15}H_{20}O$, is one of the most useful synthetics employed by perfumers, and is the indispensable base for all violet bouquets. According to patent specifications it may be prepared by the condensation of Citral with Acetone in the presence of alkalis, the resulting body yielding a mixture of two isomeric ketones known as Alpha Ionone and Beta Ionone. In practice, however, the process is cheapened by the substitution of lemon-grass oil for citral. This is mixed with equal weights of acetone and 10 per cent caustic soda solution, and after stirring for seventy-two hours at a temperature not exceeding $35^{\circ}C.$, the pseudo-ionones which have been formed are separated by distillation *in vacuo* at 130° to $150^{\circ}/5$ mm. The cyclisation of the pseudo-ionone is effected by treatment under suitable conditions, with three times its weight of 60 per cent sulphuric acid, this strength of acid having been found to yield the largest proportion of *alpha* ionone. The cheapest article met with in commerce is usually a mixture of the two ketones. This body is not used in fine perfumery, but is sold in large quantities as a soap perfume.

All three commercial ionones, alpha, beta, and 100 per cent (a mixture of the two ketones without alcohol), are manufactured by numerous firms under different trade names, the products differing slightly in aroma. When freshly prepared and of 100 per cent purity, alpha and beta ionones are colourless. Some samples met with in commerce, however, are of greenish-yellow colour, and the odour is not so delicate, probably owing to traces of citral, acetone, and terpenes. It should be noted, however, that many commercial ionones are "touched up" by the addition of traces of methyl heptene carbonate.

The following physical constants are of interest, but vary with the make :—

	Alpha.	Beta.	100 per Cent.
Specific gravity	0.934	0.949	0.937
Boiling-point at 10 mm.	—	—	127° C.
Boiling-point at 12 mm.	127° C.	134° C.	—

The odour of diluted ionone recalls orris, and when further mixed with alcohol has a marked resemblance to fresh violets. At one time this product was only obtainable in 10 per cent solution, and it is a curious fact that when first added to spirit the odour entirely disappears, but it develops again in the course of a few days. One of its peculiar properties is that of benumbing the olfactory nerves, and this has occasionally led inexperienced workers to believe that the article has no odour value whatever. As a perfume, it has been described as “thin,” and the art in its use lies in being able to so back it up in a compound that the resulting violet bouquet has “body.” The purer the ionone the more difficult becomes this operation, but the following articles will be found useful for the purpose : *Concrete Oil of Orris, Ylang-Ylang, Santalwood, Bergamot and Clary Sage Oils, Synthetic Cassie, and Heliotropin*. To obtain a leafy effect *Methyl Heptine Carbonate* is indispensable. For fine perfumery in general alpha ionone is the most useful, but for certain types, such as violette de parme, beta ionone with jasmin is preferable. In no violet compound should the ketone exceed 60 per cent of the total, the remainder consisting of blenders, modifiers, and fixers, as the following example will show :—

550	Ionone, 100 per cent alpha ketone.
10	Methyl heptine carbonate.
40	Concrete orris oil.
100	Santalwood oil.
100	Cassie synthetic.
50	Violet leaves concrete.
10	Ethyl myristinate.
140	Guaiacwood oil.
<u>1000</u>	

The use of ionone in the production of violet soaps is a very difficult art when good imitations of the flower odour are required. The tendency is generally to produce a dull rather than a sweet odour. The better results are obtained by the skilful use of clove, guaiacwood, cedarwood, and geranium oils with benzaldehyde. Methyl heptene carbonate should be avoided as after the soap has been made some days it develops a sharp and unpleasant odour. By experimenting on the basis of the appended formula, good results will be obtained :—

200	Ionone.
100	Geranium oil—African.
200	Cedarwood oil.
100	Guaiacwood oil.
40	Clove oil.
150	Bergamot oil.
50	Cananga oil.
10	Benzaldehyde.
50	Santal oil.
40	Musk ambrette residues.
60	Musk xylene.

1000

Iraldeine—*see* Methyl Ionone.

Iris—*see* Orris.

Irisol is a name given to irone synthetically prepared, to liquid orris oil, and to a mixture (solid) of acetanilid and orris oil.

Irone, $C_{13}H_{20}O$, is isomeric with ionone and is the odorous ketone present in concrete orris oil and probably also in the perfume of *Acacia cavenia* and wallflower. It is a colourless liquid, having an aroma slightly different from ionone, but quite characteristic of orris root. S.G., 0.939; B.P., $141^{\circ}C$. at 15 mm. It is prepared synthetically, starting with iso-propylidene aceto-acetic ester, and, being expensive, it has not such an extensive application as its isomer. Efforts are being made at the present time to produce this ketone economically, when it will doubtless spring into major importance.

Iso-Borneol, $C_{10}H_{17} \cdot OH$, is stereoisomeric with borneol, which it resembles in general characters. It is a crystalline substance, melting at $217^{\circ}C$. (? $212^{\circ}C$.), and on oxidation it yields camphor. It is used in theatre sprays.

Iso-Bornyl Acetate, $C_{10}H_{17}OOC \cdot CH_3$, has a sharp fragrant pine-like odour. Useful in soap perfumes. S.G., 0.990; B.P., $106^{\circ}C$.

Iso-Bornyl Formate, $C_{10}H_{17}OOC \cdot H$, has a sweet fragrant odour and is useful in soap compounds. S.G., 1.012; B.P., 90° at 10 mm.

Iso-Butyl Acetate, $(CH_3)_2 \cdot CH \cdot CH_2 \cdot OOC \cdot CH_3$, is a colourless liquid with an odour recalling a mixture of raspberry and pear. It has been recommended in traces for modifying artificial rose ottos. S.G., 0.875; B.P., $116^{\circ}C$.

Iso-Butyl Alcohol, $(CH_3)_2 \cdot CH \cdot CH_2OH$, is a liquid boiling at $108^{\circ}C$. It gives rise to a number of aromatic esters of great value in perfumery. S.G., 0.815.

Iso-Butyl Anthranilate, $NH_2 \cdot C_6H_4 \cdot COO \cdot CH_2 \cdot CH \cdot (CH_3)_2$, is a liquid having an orange-blossom odour. It is useful in such compounds. S.G., 1.058.

Iso-Butyl Benzoate, $(CH_3)_2 \cdot CH \cdot CH_2 \cdot OOC \cdot C_6H_5$, is an oil having a pleasant smell, and has been described as "Eglantine 100 per cent." It is a valuable asset in the preparation of carnation, orange blossom, sweet-pea and trèfle perfumes. S.G., 1.006; B.P., $237^{\circ}C$.

Iso-Butyl Butyrate, $(CH_3)_2 \cdot CH \cdot CH_2 \cdot OOC \cdot C_3H_7$, is a liquid of fruity odour and may be used for modifying floral bouquets. S.G., 0.864; B.P., $156^{\circ}C$.

Iso-Butyl Cinnamate, $(CH_3)_2 \cdot CH \cdot CH_2 \cdot OOC \cdot CH : CH \cdot C_6H_5$, is a colourless oil which will be found useful as a constituent of Oriental bouquets. It possesses a sweet, soft amber fragrance, and will blend well with oakmoss, vetivert, patchouli, coumarin, vanillin, and heliotropin.

It is known as *Labdanol*. S.G., 1.0112; B.P., 146° C. at 4 mm.

Iso-Butyl Formate, $(\text{CH}_3)_2 \cdot \text{CH} \cdot \text{CH}_2 \cdot \text{OOC} \cdot \text{H}$, is a liquid having an odour of the raspberry type and may be used as a modifier in perfumery. S.G., 0.890; B.P., 98° C.

Iso-Butyl Phenylacetate, $(\text{CH}_3)_2 \cdot \text{CH} \cdot \text{CH}_2 \cdot \text{OOC} \cdot \text{CH}_2 \cdot \text{C}_6\text{H}_5$, is a colourless liquid with a sweet, penetrating, musk-like odour, and like the benzoate has been named "Eglantine." It will give a beautiful, fresh note to almost any floral perfume, and in particular to tobacco, carnation, tuberose, and white rose compounds. For this purpose about 5 per cent is sufficient, but as a basis for fancy odours up to 20 per cent may be used. S.G., 0.9906; B.P., 254° C.

Iso-Butyl Propionate, $(\text{CH}_3)_2 \cdot \text{CH} \cdot \text{CH}_2 \cdot \text{OOC} \cdot \text{C}_2\text{H}_5$, is a liquid of intense fruity odour recalling rum and is used in the manufacture of fruit essences. S.G., 0.890; B.P., 137° C.

Iso-Butyl Quinoline, $(\text{CH}_3)_2 \cdot \text{CH}_2 \cdot \text{C}_9\text{H}_6\text{N}$, is a viscous oil having a powerful odour reminiscent of oakmoss. It may be used in fancy chypre type perfumes.

Iso-Butyl Salicylate, $(\text{CH}_3)_2 \cdot \text{CH} \cdot \text{CH}_2 \cdot \text{OOC} \cdot \text{C}_6\text{H}_4 \cdot \text{OH}$, is a colourless fragrant liquid with an odour resembling amyl salicylate but of a decidedly finer quality. It is useful in trèfle, orchidée, etc., and possesses certain advantages over methyl salicylate for compounding synthetic cassie. It blends well with carnation compounds for producing novel effects. S.G., 1.074; B.P., 259° C.

Iso-Butyl Valerianate, $(\text{CH}_3)_2 \cdot \text{CH} \cdot \text{CH}_2 \cdot \text{OOC} \cdot \text{C}_4\text{H}_9$, is a liquid of fruity fragrance. Traces are useful as a modifier of perfumes. S.G., 0.860; B.P., 168° C.

Iso-Eugenol, $\text{C}_{10}\text{H}_{12}\text{O}_2$, occurs naturally in oils of ylang-ylang, nutmeg, and champaca flowers, but may be prepared artificially by treating eugenol with (amyl) alcoholic potash.

In commerce it is usually a light yellow, viscous liquid, having an odour recalling clove pink, and is of considerable importance in the manufacture of **Vanillin**. In the pure state it is a white crystalline solid melting at 24° to 25° C. and boiling at 261° C., and having a specific gravity of 1.089. Iso-eugenol is most useful as a base for carnation perfumes, and in combination with musk and civet is employed largely in producing Oriental ottos. The following formula will illustrate its application in the compounding of synthetic œillet :—

400	Iso-eugenol.
200	Eugenol.
100	Rhodinol.
50	Terpineol.
30	Alpha ionone.
80	Heliotropin.
20	Iso-butyl phenylacetate.
50	Benzyl salicylate.
70	Benzoin R.
<hr/> 1000 <hr/>	

***p*-Iso-Propyl Acetophenone**, $\text{CH}_3 \cdot \text{CH}(\text{CH}_3) \cdot \text{C}_6\text{H}_4 \cdot \text{CO} \cdot \text{CH}_3$, is an oil having an odour reminiscent of orris.

Iso-Propyl Alcohol, $\text{CH}_3 \cdot \text{CHOH} \cdot \text{CH}_3$, has received much attention as a substitute for ethyl alcohol in the preparation of perfumery products. According to Grant and Johns,¹ it is produced solely as a by-product of the petroleum and natural gas industry in the United States, and is made by absorbing olefine gases, containing propylene, in sulphuric acid and hydrolysing the resulting alkyl sulphuric acids. The crude alcohol is separated by distillation and purified by chemical treatment and rectification. The anhydrous alcohol boils at 82.4° C. and has a specific gravity of 0.789 at 15.6° C. It is a colourless liquid, with a characteristic alcoholic odour, and is miscible in all proportions with water, but may be salted out by saturating the solution with sodium chloride. In Britain large quantities are prepared

¹ "American Journal of Pharmacy," June (1922).

from acetone, and the product has recently been so much improved that its odour may be described, without exaggeration, as slightly fragrant. It does not, of course, possess that vinous quality characteristic of ethyl alcohol. Many eminent scientists have investigated the pharmacology of iso-propyl alcohol, and their experiments show that its toxicity is not less than that of ethyl alcohol, and not more than twice that of ethyl alcohol. The effect of iso-propyl alcohol on the skin is similar to that of ethyl alcohol. No reasonable objection can therefore be raised to its use in the preparation of perfumes, hair washes, dentifrices, toilet waters, etc.

The peculiar fragrance of this alcohol is difficult to cover if the perfume ingredients are added to it without previous preparation. For pleasing results it must be treated very much on the lines of *Prefixation* outlined in Volume II. of this work, and in addition small quantities of esters, having the type odour of the particular perfume being prepared, should be added and the solvent matured for as long as possible. The fixator may be chosen from the list given in Volume II. and the ester from the following :—

Acacia—iso-butyl phenylacetate, methyl anthranilate, amyl cinnamate, citronellyl propionate.

Carnation—amyl salicylate, geranyl formate, terpinyl acetate, ethyl benzoate.

Cologne—linalyl acetate, ethyl anthranilate, iso-butyl cinnamate.

Hawthorn—benzyl acetate, rhodiny butyrate, phenyl-ethyl acetate.

Heliotrope—benzyl cinnamate, amyl formate, terpinyl propionate.

Honeysuckle—para-cresyl phenylacetate, methyl methyl-anthranilate.

Hyacinth—amyl valerianate, benzyl propionate, styrollyl acetate.

Jasmin—benzyl formate, octyl acetate, methyl anthranilate.

Lavender—terpinyl propionate, phenylethyl butyrate.

Lilac—*n*-butyl phenylacetate, benzyl acetate, terpinyl formate.

Muguet—ethyl phenylacetate, geranyl formate.

Narcissus—phenyl-glycol acetate, para-cresyl phenylacetate, ethyl anthranilate.

Rose—geranyl butyrate, citronellyl acetate.

Sweet-pea—iso-butyl phenylacetate, rhodinyll formate.

Trèfle—iso-butyl salicylate, linalyl acetate.

Violet—linalyl acetate, amyl laurate, ethyl myristinate.

Wallflower—ethyl anthranilate, methyl para-cresol.

After maturing, the perfume may be compounded with terpeneless oils and synthetics, and for cheap products, diluted with water to 60 to 30 per cent strength. It can never be argued, however, that these perfumes compare favourably with those prepared with ethyl alcohol. As a solvent for essential oils, 40 per cent iso-propyl alcohol is about equal to 80 per cent ethyl alcohol. As a gum-resin solvent this alcohol is useful and may be successfully employed in preparing such resin-odours as olibanum, galbanum, and ginger, but for delicate odorous bodies such as benzoin and cistus it is not recommended.

Iso-Propyl Benzyl Carbinol, $C_6H_5 \cdot CH_2 \cdot CH[CH(CH_3)_2] \cdot OH$, is a mobile liquid having an odour of mignonette.

Iso-Propyl Esters.—A complete range of these is now available, and with experiment a use will be found for each one of them. Iso-propyl propionate is a particularly interesting example.

***p*-Iso-Propyl Phenylacetaldehyde**, $CH(CH_3)_2 \cdot C_6H_4 \cdot CH_2 \cdot CHO$, is an oil having a somewhat green type of odour reminding of the freshly peeled cortex of newly grown tree branches. It is known also under the name "Cortexal."

Iso-Propyl Quinoline, $\text{CH}(\text{CH}_3)_2 \cdot \text{C}_9\text{H}_6 \cdot \text{N}$, is a liquid having an intense and persistent odour recalling that of smoke. It is known also under the name "Lichenol."

Iso-Pulegol, $\text{C}_{10}\text{H}_{17}\text{OH}$, is an alcohol having a sweet mint-like odour reminiscent of the first smell of tuberose. S.G., 0.915; B.P., 100°C . at 11 mm.

Iso-Pulegyl Acetate, $\text{C}_{10}\text{H}_{17}\text{OOC} \cdot \text{CH}_3$, has a sweet odour suggestive of American peppermint. It is useful in combination with lavender in such compounds. S.G., 0.9218; B.P., 112°C . at 11 mm.

Iso-Pulegyl Formate, $\text{C}_{10}\text{H}_{17}\text{OOC} \cdot \text{H}$, has properties similar to the alcohol with a more pronounced shading of tuberose and is used in these compounds. S.G., 0.9550; B.P., 91°C . at 4 mm.

Iso-Safrole, $\text{C}_{10}\text{H}_{10}\text{O}_2$, is a colourless, fragrant liquid isomeric with safrole and obtained from it by treatment with alcoholic potash. It probably occurs naturally as a constituent of ylang-ylang oil. Iso-safrole is used in the manufacture of heliotropin, in soap perfumery, and in traces for modifying bouquets of the "Eastern" type. S.G., 1.126; B.P., 254°C .

Iva Oil is obtained by distillation of *Achillea moschata*, L., a herb belonging to the N.O. Compositæ, and found growing at high altitudes on the mountains of Switzerland where it is employed in the manufacture of liqueurs. The yield of oil is about 0.5 per cent of dry herb, it is a liquid of blue-green colour which turns to olive-green in the course of time. Its odour is intensely aromatic. Iva oil has been examined by Schimmel & Co.¹ who found it to contain cineole, *l*-camphor, and probably valeric aldehyde. So far it does not appear to have been employed in perfumery.

Jaborandi Leaves are obtained from *Pilocarpus Jaborandi*, Holmes, *P. microphyllus*, Stapf., and other species of

¹ "Reports," April (1912), 83; October (1915), 24.

the N.O. Rutaceæ, a plant grown in South America (principally Brazil). A tincture 1 in 5 and a liquid extract 1 in 1 are made with 45 per cent alcohol, and both are useful in hair preparations. The alkaloid **Pilocarpine** is obtained from jaborandi and is used medicinally. Jaborandi leaves contain about 0·5 per cent of essential oil, having an odour resembling rue.

Jacinthe—*see* Hyacinth.

Japan Flowers—Bouquets of this name were at one time popular. Gattefossé¹ gives the following formula, which on maturing makes a suitable perfume for toilet preparations :—

80	Vanillin.
100	Musk ketone.
250	Geranium de France, terpenless.
60	Patchouli oil.
150	Jasmin synthetic.
150	Heliotropin.
30	Iso-eugenol.
200	Cananga oil.
80	Rose, synthetic.
10	Mousse de chêne.
60	Benzoin resinodor.
30	Fleur d'oranger absolute.
1200	

Japan Wax—*see* Waxes. "

Jaracanda is a name for Bois de Rose.

Jasmin—The jasmin perfume is obtained by means of volatile solvents or enfleurage from the flowers of *Jasminum grandiflorum* L., and allied species, N.O. Oleaceæ. In commerce there are four types of absolute available ; 1, that extracted with petroleum ether as solvent and used in fine perfumery ; 2, the same using benzole which yields a larger percentage having a more fruity odour and in consequence is cheaper ; 3, discarded chassis flowers extracted with solvent and having an odour of more indoloid character.

¹ "Agenda du chimiste Parfumeur" (1918), 128.



[*Antoine Chiris.*

FIG. 15.—A field of Jasmin at L'Abadie.

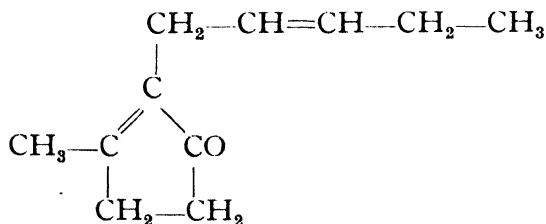
[*To face page 226.*

Much used in compound manufacture ; 4, concentrated washings from enfleurage fats. The composition of the jasmin perfume is approximately known due to the analysis by Hesse and Muller, since which time the production of artificial jasmins has been facilitated. For details and formulæ see the monograph in Volume II.

Jasmin Aldehyde—see Amyl Cinnamic Aldehyde.

Jasmone is the name given to a ketone of the formula $C_{11}H_{16}O$, found to the extent of about 3 per cent in jasmin oil and probably occurring also in the oils of jonquille, neroli, and orange blossom absolute. It was first discovered in 1899 by A. Hesse in the laboratories of Heine & Co., A.G., and its chemical constitution has since been independently established by well-known organic chemists. During 1926 Messrs. Ruzicka & Pfeiffer resolved its constitution in the laboratories of Naef, and on 12th May, 1927, filed a sealed envelope with the Swiss Chemical Society. This was opened by the editorial board on 26th September, 1933, at the request of the authors. In the meantime Messrs. Treff & Werner had been working on this synthesis in the laboratories of Heine and filed the results of their research on 5th August, 1933. A controversy has consequently arisen as to the priority of discovery, and opinion naturally depends upon the customary point of view prevailing amongst chemists of different nationalities.

Complete accounts of this work were issued by both of the above-mentioned firms in booklet form, from which the constitution of jasmone is therefore a 3-methyl-2- $[n$ -penten-(2')-yl]-cyclopenten-(2)-on-(1) of the formula



At present jasmone of recognised chemical structure is not available commercially, but a synthetic product of very near composition can be had from either firm. Both are undoubtedly of intrinsic value in the building up of jasmin compounds.

Jatamansi is a name given in India to the true spike-nard (*which see*), and is a synonym also for sumbul root.

Jockey Club—Perfumes bearing this name are legion, and it is strange to say that nearly all of them differ materially in odour value. The original perfume is said to have been an imitation of the pleasant fragrance pervading the downs at Epsom in the late spring (before the Derby) and wafted across the racecourse from the woods to the jockey club in the grandstand. Bouquets which will answer to this description may be compounded from jasmin, mimosa, rose, tuberose, orris, and bergamot as follows :—

200	Bergamot.
100	Rhodinol.
50	Benzyl acetate.
50	Terpineol.
300	Jasmin compound.
100	Mimosa ,,
100	Tuberose ,,
100	Violet ,,
<u>1000</u>	

Jonquille belongs to the narcissus family and is sometimes called rush daffodil. The base of many jonquille perfumes is phenylethyl-phenylacetate, the odour of which recalls that of the flower. If suitably backed up with jasmin, rose, styrolyl acetate, and traces of basil and patchouli oils, a good imitation of the flower perfume results. For formulæ and further details see the monograph in Volume II.

Kachi Grass Oil is obtained by distillation from *Cymbopogon Cæsius*, Stapf., a grass growing freely in Bangalore and on the high-lying tableland of Mysore. The



Fig. 16. — Jongquilles.

[Antoine Chiris,

[To face page 228.

plant is closely allied to *C. Martini*, Stapf., and yields about one-half per cent of essential oil, having an odour similar to that of ginger-grass. According to the investigations of Rao and Sudborough¹ this oil contains geraniol, perilla alcohol, dipentene, and *l*-limonene. This grass appears to thrive also in Travancore, where it is known as **Inchi Grass**, but an oil distilled from it and examined by Moudgill² contained different substances, which rather indicates a dissimilarity in the raw material. Compare a note by Schimmel³ who found the oil to have an odour reminiscent of Ceylon citronella.

Kananga Oil—see *Cananga* and *Ylang-Ylang*.

Kaolin is a fine variety of white or greyish-white porcelain clay resulting from the disintegration of the rock known as pegmatite. It consists principally of aluminium silicate, and is also known as china clay and orthoclase. It has the formula $\text{Al}_2\text{O}_3 \cdot 2\text{SiO}_2 \cdot 2\text{H}_2\text{O}$. A superior quality of this material, called **Osmo-Kaolin**, is electrolytically purified. The process consists essentially in causing the solid particles to deposit in a coherent form comparatively free from liquid on an electrode or intervening partition of semi-pervious material. China clay consists of particles having different physical properties—granular, colloidal, etc., and when submitted to electro-osmotic action only those particles having electro-osmotic properties are deposited at the anode and the finer of these first. The deposit is removed before the coarser particles become attached to the anode and thus the product osmo-kaolin consists only of the pure hydrated aluminium silicate, the particles being no larger than bacteria. It is a clean, smooth, creamy-white *colloidal* powder, and has found employment in medicine for the treatment of dysentery, summer diarrhoea, colitis, and similar bacterial infections. It is also superior to the ordinary commercial article as a

¹ "J. Ind. Inst. Sc.," 8, A (1925), 9.

² "J. Ind. Chem. Sc.," 2 (1925), 23.

³ "Report" (1926), 64.

filtering medium. It is of particular interest to perfumers as it is especially well adapted for use in face powders, being peculiarly adherent. It is also a good substitute for precipitated chalk in the manufacture of tooth pastes. The following formula will indicate its application in face powders :—

300	Osmo-kaolin.
200	Rice starch.
200	Zinc oxide.
250	Talcum.
50	Magnesium stearate.
10	Methyl ionone.
10	Carnation.
10	Amber liquid.
<u>1030</u>	

Kapur-Kachri.—The product bearing this name in the Hindu, Bengalee, and Bombay dialects, and valued as a perfume in the East, especially by the Arabs and Persians, and used by the Hindus as incense in worship, consists of the dried root of *Hedychium spicatum*, Smith, N.O. Scitamineæ. For further details, see Sawers' "Odorographia," second series, p. 72. Compare also Longoza Oil.

Karaya Gum, known also as Indian Tragacanth, is obtained from *Sterculia urens*, Roxburgh, a plant belonging to the family Sterculiaceæ. It occurs in the form of irregular lumps or tears, the small trees being tapped in the dense forests adjacent to the Bombay territory. The bagged gum is transported to this city, where it is sorted into various grades. Karaya gum is sometimes used as a substitute for tragacanth, although its higher acidity may be objectionable in some preparations. It has, however, to a large extent replaced the more expensive quince seed in hand and wave-set lotions. The active principle is Bassorin which occurs to the extent of about 80 per cent. When dissolved in water Karaya swells to form a jelly which upon dilution produces a thick transparent mucilage.

Karo-Karundé is the name given by natives of French

Guinea to *Leptactina Senegaentica*, Hook, f., a shrub belonging to the N.O. Rubiaceæ and attaining a height of 6 or 8 feet. It grows profusely in the region of Fonta-Djalon, and bears strongly perfumed white flowers having an odour of ylang-ylang type. These flowers are extracted by volatile solvents in the Caps factory at Labé and yield about 0·13 per cent of concrete, having an orange-red colour. This yields 60 to 65 per cent absolute by the usual methods, but it suffers from the disadvantage of considerable darkening with age. The decolorised absolute is a golden yellow colour and has a powerful and characteristic odour, reminiscent of a vegetable jasmin-ylang combination. Its use has been recommended in violet compounds, but experiments conducted with it by the author rather marred than improved this delicate flower bouquet. The chemistry of Karo-Karundé has been studied by Trabaud, Sabetay, and Palfray¹ who found the absolute to contain a high content of nitriles, this constituent probably accounting for its lack of appreciation.

Kashmirja, Kastam—see *Costus*.

Katchung Oil, also known as arachis and pea-nut oil, is obtained from the seeds of *Arachis hypogæa*, L., N.O. Leguminosæ, a plant growing in India, etc. This is an annual attaining a height of about 3 feet. The fruit developing from the lower flowers, grow downwards into the earth and there ripen. Each plant produces from 60 to 100 fruits and each fruit one to three brownish-red seeds. When subjected to pressure these yield about 45 per cent of fixed oil which is a cheap substitute for expressed oil of almonds.

Kewda Oil is obtained by extraction from the wild flowers of *Pandanus odoratissimus*, L., the only aromatic member of the N.O. Pandanaceæ. It thrives in India and grows to a lesser extent in the Andaman Islands and Singapore. Apparently the best blossoms come from the

¹ "P. and E.O.R." (1938), 344.

Gangam district of the new province of Orissa, although they are found also in south-west Bengal and north-west Burma. A tropical climate with heavy monsoons is conducive to a large development of flowers. The plant averages a height of 10 to 12 feet, although it may reach 25 feet in exceptional places. The leaves are long and spiny. The blossoms appear between July and December and vary in shade between yellow and white. The main crop is in August/September. A well-developed flower weighs about 100 grammes. The finest oil comes from pearly-white flowers and is, according to Sadgopal,¹ of a strong typically oriental character, comparatively heavy and yet refreshing. This chemist describes the odour as having the character of lilac, honey, and ylang with hyacinth and tuberose notes predominating. The percentage yield is given as between 0.1 and 0.3 of a light yellow oil, which on analysis revealed the presence of benzyl alcohol, acetate, benzoate and salicylate, geraniol, linalol and acetate, phenylethyl alcohol, santalol, guaiacol, and bromstyrole. A sample of the oil has been kindly supplied to the author by Sadgopal, and in his opinion the odour is reminiscent of phenylacetaldehyde dimethyl acetal and would consequently be useful for imparting the green note to lilac, rose, muguet, etc.

Khus-Khus Oil is oil of vetiver (*which see*).

Kieselguhr, SiO_2 , is mainly silicon dioxide, and consists of the remains of extinct diatoms.² It is met with in commerce as a white or greyish-white powder and is used as a base for coloured dental creams and powders. Owing to its being adherent and light it is sometimes used in face powders up to 10 per cent.

Kiou-Nouk is obtained by a special process from olibanum, the gum-resin of *Boswellia Carterii*, Birdw., and

¹ "Soap, Perfumery and Cosmetics" (May, 1937), 396.

² For a very complete account consult the paper read by J. Moss before the British Pharmaceutical Conference, 1898—"Y.B.P.," p. 337.

other species of the N.O. Burseraceæ. It occurs as a clear, transparent, yellowish, semi-liquid resin and is a speciality of a well-known Grasse firm. It is superior to the ordinary resinodor obtained from olibanum in that it does not darken with age and it has a more aromatic and less sickly odour. As a fixator in bouquets it is excellent. It blends well with almost any of the essential oils and musks, vanillin, coumarin, and heliotropin.

Kur, Kushtha, Kusta, Kuth—see Costus.

Kuro-Moji Oil is distilled on a small scale by farmers in Japan from *Lindera fericia*, Bl., a shrub belonging to the family Lauraceæ and found growing in all the mountainous regions of that country. The whole plant is aromatic and the wood is employed for the manufacture of toothpicks. Some oils appear to be distilled from the leaves only, others from the whole plant. Specimens which have reached Europe are powerfully aromatic and balsamic, some being light yellow in colour and others much darker. The following constituents have been identified in oils from different sources—terpineol, carvone, dipentene, limonene, cineol, linalol, and geranyl acetate. Kuro-moji oil would therefore appear to be a useful raw material for perfumery when obtainable.

Labdanol—see Iso-butyl Cinnamate.

Labdanum is an oleo-resinous secretion from the leaves of several species of *Cistus*, a genus of the rock rose family (*Cistinæ*), particularly *C. creticus*, L., and *C. ladaniferus*, L. These plants are widely distributed over the rocky ground of Macedonia, Thrace, Greece, Southern France, Spain, Portugal, Northern Africa, and the islands of Crete and Cyprus, where they are very abundant. In spring, and especially in summer, the very numerous glandular hairs of the leaves and young stems exude a large quantity of a sticky, balsamic, resinous substance with an odour varying very much according to the species in question and

giving a very characteristic odour to the thickets in which the cistus grows. According to A. Camus¹ the oleo-resinous substance is yielded most freely from May to July and towards noon, but the extremity of the branches is always highly glutinous, and the exudation is often fairly abundant as early as March. In Cyprus, labdanum was at one time collected by the shepherds by combing it from the fleeces of the sheep, which become loaded while they are pasturing. In Crete, and apparently now in Cyprus, a special instrument called a *ladanisterion* is employed. It is a kind of double rake with leathern thongs instead of teeth and is used in the manner of a whip. The straps become quite cylindrical and rope-like when fully charged by the adhering resin, and this is ultimately scraped off with a knife. It is subsequently purified, as much as 60 per cent of sand being sometimes removed in the process. The resin may also be obtained by boiling the branches in water, this method being frequently adopted in Spain. In France, however, much more economical and up-to-date methods are employed, the gum-resin being extracted direct from the plant by means of volatile solvents. The product obtained by this means is distinctly superior, both in odour (absence of ammoniacal taint) and colour. After very careful examination of labdanums from different sources, the author is of the opinion that the plants gathered in the Esterel (the district lying in the hills to the west of Cannes) yield the product having the finest odour for high-class perfumery.

Labdanum was formerly placed on the market in cakes, small balls, twists, cords, rods, and in bladders, where the resin continued to assume consistence. The crude material is now imported in dark brownish or greenish lumps, which almost invariably contain hairs and pieces of broken leaf. From this debris it is possible to determine the species of cistus from which the commercial labdanum was extracted. Labdanum has at all times been employed either in medicine

¹ Roure-Bertrand Fils, "Bulletin" (October, 1920), 4.



[Les Parfums de France,
FIG. 17. —Flowers of *Cistus ladaniferus*.
[To face page 234.



FIG. 18.—*Cistus ladaniferus* growing in the Esterel.

[*Les Parfums de France.*

[*To face page 235*

or perfumery,¹ and to-day is one of the common constituents of fumigating pastilles.

The purification of the commercial article is easy and can be accomplished by maceration with strong alcohol, or petroleum ether, the extraneous matter being removed by filtration and the resulting clear liquid concentrated at a low temperature *in vacuo*. The colour of the purified gum-resin may be either yellowish-brown or green, and the odour of some specimens is faintly ammoniacal, which may be due to the contamination of the oleo-resin with nitrogenous matter. A good sample has a powerful but sweet characteristic odour, recalling ambergris, and possesses wonderful fixative properties. Labdanum yields between 1 and 2 per cent of volatile oil having the characteristic odour of the oleo-resin. It has been examined by Masson² who identified as constituents two ketones—acetophenone and trimethyl-1, 5, 5-hexanone-6. The former had not previously been found in nature but has recently been shown³ to occur in the oil of *Stirlingia latifolia*, Stend., a small shrub of the family Proteaceæ.

Labdanum in a purified and soluble form is an extremely important perfumery raw material for two reasons, first the close resemblance of its odour to that of ambergris and second its economy of application. It is used as a fixator in many bouquets of the lavender, fern, chypre, verbenæ, and violet types, but its principal employment is in the manufacture of artificial ambers; such products are referred to elsewhere in this volume and in more detail also in the second volume.

Labdanum is employed in soap perfumery as a fixator for lavender, fern, and chypre compounds.

Lactic Acid, $\text{CH}_3 \cdot \text{CHOH} \cdot \text{COOH}$, is a colourless syrupy liquid containing up to 75 per cent of hydrogen

¹ For a complete account consult the author's article in the "American Perfumer" (1924), 311.

² "Comptes Rendus," 154 (1912), 517.

³ By the London Imperial Institute.

lactate. It may be prepared from lactose by fermentation. In sour milk this is due to the action of *Bacillus acidi lactici*. Commercially lactic acid is obtained from sugar by the addition of decayed cheese which contains an abundance of the lactic acid bacilli. As the acid is formed it is neutralised with chalk or lime (calcium oxide) and after filtering out is decomposed by sulphuric acid. Lactic acid is used in the preparation of buttermilk lotions. A 2 per cent solution in fluid pectin mucilage, suitably perfumed, makes a good skin bleach.

Lanette Wax—see Stearyl Alcohol.

Lanolin, also known as *Adeps lanæ*, or wool fat, is the purified cholesterin—fat of the wool of the sheep, *Ovis aries*. The fleeces contain from 15 to 20 per cent, which is separated either by “scouring” with soap solution or by extraction with volatile solvents. The free fatty acids are removed and the fat bleached by suitable means. It is a yellowish, tenacious, unctuous substance, almost inodorous in the best qualities, with a melting-point varying from 40° to 44° C. It is used in pharmacy as a basis for ointments. For toilet preparations it is valued on account of its ready absorption by the skin and the absence of a tendency to rancidity. In the manufacture of toilet soaps up to 2 per cent is employed for the purpose of “super-fatting.” It is commonly known as *anhydrous* lanoline. Hydrous wool fat consists of 70 parts of *Adeps lanæ* with 30 parts of water, and is generally known as lanoline.

Lard, or *adeps*, is the purified fat of the hog—*Sus scrofa*. It is a firm white substance fusing about 38° C. and consisting of olein (about 50 per cent), palmitin, stearin, laurin, myristin, and a little linolin. It is used as an ointment base in pharmacy and for skin creams and hair pomades in cosmetics. It is the basis of most of the fats used in enflourage (*which see*). In order to prevent rancidity, it may be digested at 60° C. for one hour with 3 to 5 per cent of gum benzoin.



[W.A.P.]

FIG. 19.—Harvesting English Lavender at Fring, Norfolk.

[To face page 237.]

Lathyrus Odorata—*see* Sweet-pea.

Laurinyl Esters—Several esters are now prepared from duodecyl alcohol. They have unique odour characters and are used only in fine perfumery. The propionic acid ester, $C_2H_5 \cdot COOC_{12}H_{25}$, has a pronounced odour of mushrooms and resembles that of truffles.

Lavandin Oil is obtained by distillation of the flowers of *Lavandula latifolia fragrans*, Chatenier, a hybrid of the N.O. Labiatae, produced by a crossing of lavender and spike. According to Lamothe¹ the plant covers the southern slopes of several mountains in the lower Alps, it is prolific in its development and blossoms two or three weeks later in the season than true lavender. He estimates that lavandin oil constitutes 20 per cent of the total lavender oils produced. The crop is more easily collected than that of *L. vera*, D.C., because of the higher plants and longer stems. Curiously enough the yield of oil seems to bear some inverse relationship to the ester content. For instance, oils containing 40 per cent esters are obtained in 1 per cent yield, whereas those containing 20 to 22 per cent esters are obtained to the extent of 2 to $2\frac{1}{2}$ per cent yield. One type called "Eureka" yields over 3 per cent of oil having an ester content of 34 per cent. Unselected lavandin yields, *per hectare*, about five times as much oil as true lavender. If the plants are taken weight for weight then the yield is on an average, about 50 per cent greater. Commercial samples of lavandin oil have an ester content of 20 to 22 per cent and the odour has a camphoraceous character, lacking the "punch" of true lavender. It is of considerable value in the soap industry.

Lavender Oil is obtained by distillation from the flowers of *Lavandula vera*, D.C., plants belonging to the family Labiatae and native of the lower Alps bordering on the Mediterranean. In France the volatile oil is obtained largely from wild plants, whereas in England it is distilled

¹ "La Parfumerie Moderne," 5 (1912), 9.

exclusively from cultivated species. At one time the principal English centres were Mitcham in Surrey and the New Holland district of Lincolnshire. Of late years the operations of the builder have moved the cultivation further afield in Surrey—even as far as Banstead and Ewell, and in Lincolnshire practically no oil is now distilled. The plant is, however, cultivated elsewhere, the principal district being centred at Fring in Norfolk. Small quantities are grown at Long Melford in Suffolk, Hitchin in Hertfordshire, and some parts of Kent. The development of the lavender industry in Norfolk during the last few years is due to the support of Messrs. Yardley & Co., Ltd., who equipped a modern distillery at Fring where they extract large quantities of a very fine oil. The plants were first grown in Norfolk by Mr. Linn Chilvers, a well-known horticulturist, on the estate of Mr. F. E. Dugate. The plantations now cover a wide area, including Fring, Heacham, Bircham, Snettisham, Dursingham, and Appleton. Two varieties of plants are cultivated—a selected stock of a variety known as Dwarf Munstead, very like that grown in the higher part of the Alpes-Maritimes, and Giant Blue, a most prolific type. Propagation is by means of slips, transplanted to the open fields from nursery beds from October onwards. They are arranged in rows which are about 4 feet apart. The ground is well cleaned of weeds and a rough, stony soil having a southern aspect is preferred. The young plants do not yield much oil—7 or 8 lb. to the acre being normal for the first year and a little more in the second. The best yields of oil are obtained in the third, fourth, and fifth years, after which the plants decline and are destroyed after the seventh year.

The yield of oil from well-established lavender depends upon several factors, the only one exerting a constant influence being the weather. If the figures are based upon yield from weight of plant material it is obvious that the length of stem entering the stills will affect the yield since they contain no oil. On this basis the average yield from Giant Blue is about 1 per cent, but from Munstead con-



FIG. 20. — Dwarf Munstead Lavender.

[W.A.P.]

[To face page 238.]



FIG. 21.—Giant Blue Lavender.

[W.A.P.]

[To face page 239.]

siderably less at present. If, on the other hand, the yield per acre is required, then the proximity of the plants to one another and their number per acre affect the amount of oil obtained. On the basis of 4 ft. \times 4 ft. planting the average yield of Giant Blue is about 20 lb. per acre.

The harvest is collected during August, and the oil content of the flowers is at its highest if the cutting is preceded by a few weeks sunny weather. A dull and cloudy summer, whilst it may produce a fair crop of blooms, results in a poor yield of oil. Local women collect the harvest and cut off the inflorescence with a minimum length of stem. This is placed in sacks and transported to the distillery for treatment on the following day. Distillation has for some years been controlled by the author in the modern scientific plant installed by Messrs. Yardley at Fring. Small copper stills are used with pure tin condensers. Direct steam at 60 lb. pressure to the square inch is conducted into the base of the stills and the oil separated in glass receptacles. This is collected in tin-lined drums and at the Company's works ultimately decanted into glass bottles where it matures in a dark and cool atmosphere for some months. The raw, still odour present in all freshly distilled oils disappears if the containers are left open for a few weeks.

The oils are examined in the Yardley laboratories after the harvest each year by J. H. Seager, who, in a private communication to the author, gives the following analyses for oils from 1933 to 1940 inclusive :—

Giant Blue.—Esters calculated as linalyl acetate, extreme limits, 8.4 to 16.2 per cent, but mostly 11 to 13 per cent. Free alcohols calculated as linalol (Glichitch), 45 to 59 per cent (except 1937, when the free alcohols appeared to be 74 to 78 per cent, of which 5 to 8 per cent are primary or secondary alcohols).

Dwarf Munstead.—Esters as linalyl acetate, 17 to 25 per cent. Free alcohols as linalol (Glichitch), 52 to 59 per cent, of which 6 to 7 per cent are primary or secondary alcohols.

In spite of the low ester content of English oil, there is no doubt that it is the most esteemed and will always

fetch a price far in excess of that of the finest French oils.

Lavender is now cultivated in considerable quantity on the Bridestowe Estate, Tasmania, the plants having been originally obtained from altitudes over 3000 ft. in the south of France. A fine oil is said to be obtained in a yield not exceeding 18 lb. to a ton of herb. The harvest in 1935 reached 20 tons, and the acreage was increased by 40 per cent in the following year.

In France the crop of lavender flowers varies very much in accordance with the atmospheric conditions and is particularly influenced by dryness of the air. The average yields in a normal season together with the principal production areas are as follows :—

Department of Drôme . . .	about 2000 tons.
„ Basses-alpes . . .	900 „
„ Vancluse . . .	850 „
„ Hautes-alpes . . .	450 „
„ Alpes-maritimes . . .	340 „

It is estimated that there are nearly 75,000 acres of natural lavender fields in these departments, and the plants bearing flowers of the finest odour are generally found at the higher altitudes—2000 to 3700 feet.

The yield of flowers and of oil from the lavender fields can be increased by adopting the cultural methods suggested by E. Zacharewicz.¹ The fields are ploughed or furrows are hoed either in the autumn or in March. This leaves rows of plants about 1 yard apart. This method causes the loss of some plants but is more than compensated for by the rapid development of the remaining plants, which, when suitably fertilised, give almost double the yield. Cultivation may also be started with layers or with seed—the choice depending on circumstances. The former give a greater yield in the first four years whereas the latter show a lower initial cost. The layers are planted preferably in the spring, to avoid frosts, but

¹ “Culture de la lavande vraie” through “Report” of Schimmel & Co. (April, 1908), 65.

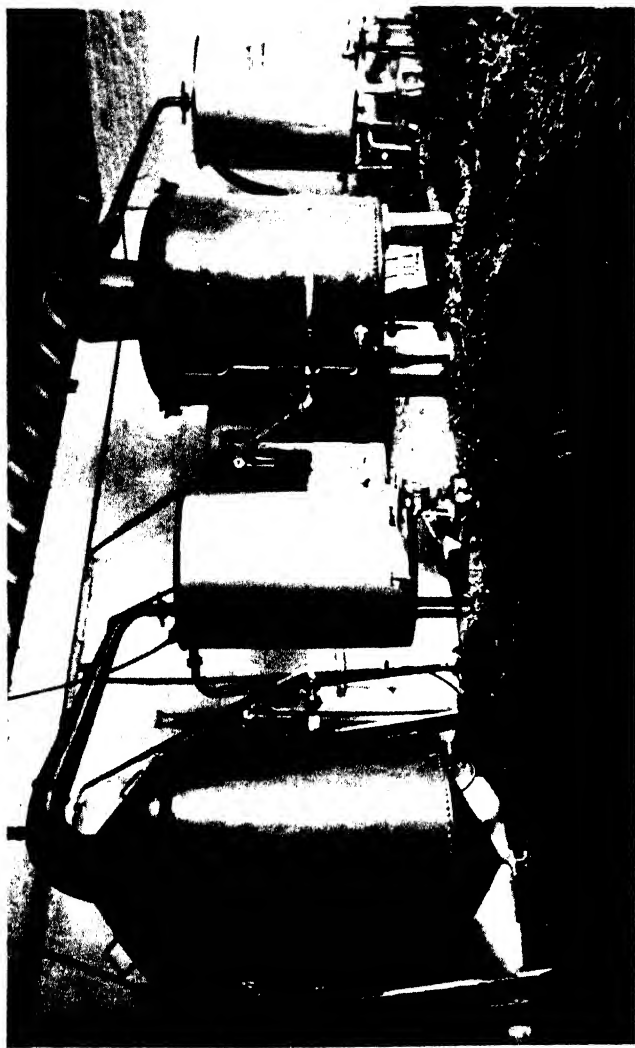
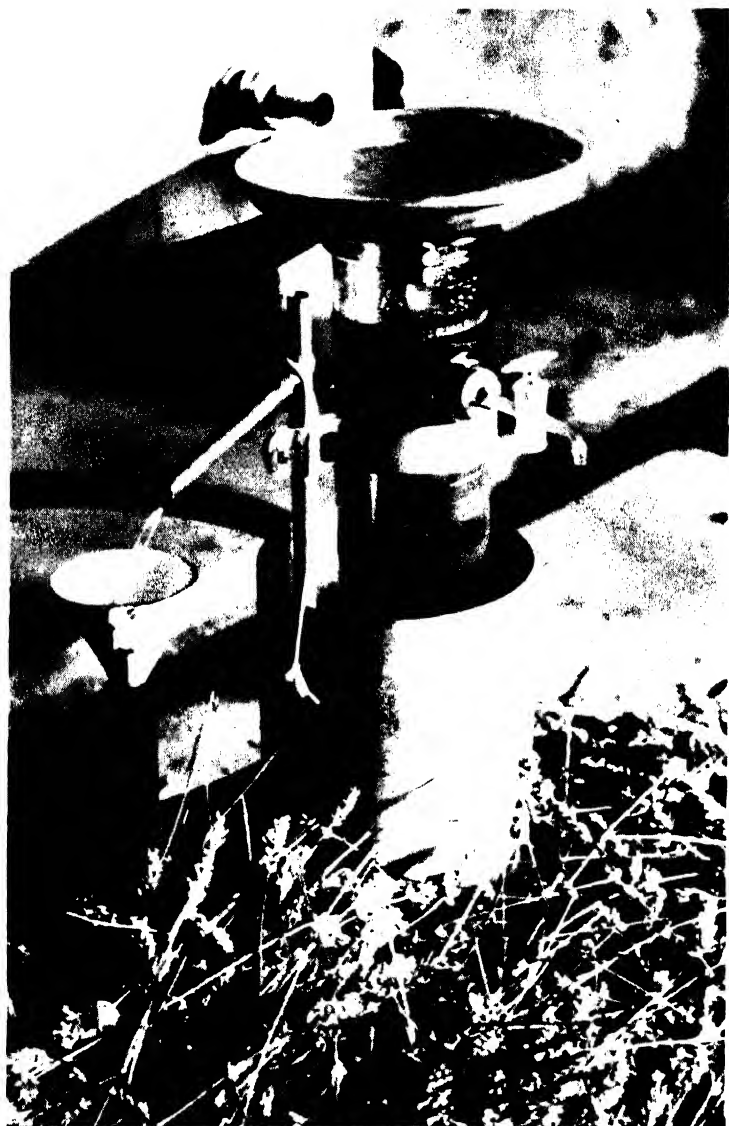


FIG. 22.—A corner of Yardley's Modern Distillery at Fring, Norfolk.

[W.A.P.]

[To face page 240]



[W.A.P.]

FIG. 23.—Lavender Oil Receiver.

The oil floats on the surface of the water, which is continuously syphoned off from below.

[To face page 241.]

sometimes in the autumn. They are placed about 2 feet apart and in rows. The seed can also be sown at the same times of the year and in rows at a depth of a few centimetres. Cultivation demands that the soil is turned twice a year, once at the commencement of winter and once in March ; during the latter the manure, which had previously been distributed between the rows, is worked into the soil. According to Zacharewicz the most suitable manure is as follows :—

Sodium nitrate	20 per cent.
Potassium chloride	20 „
Superphosphate 18/20	60 „

It is employed in the proportion of 500 kilos per hectare.

According to the investigations of Autran and Fondard¹ nitrogen manures are the most active in raising the yield of flowers (but not necessarily the oil content), as the following figures in kilos per hectare show :—

Without manure	2050
Sodium nitrate	4040
Ammonium sulphate	4000
Superphosphate	3000
Potassium chloride	1750
Potassium sulphate	1750
Superphosphate and sodium nitrate	3600

The yield of oil according to fertiliser is set out below :—

Manure.	Yield per 100 kilos of Flowers.	Yield per Hectare.
None	0.601 kilo	12.320 kilos
Sodium nitrate	0.604 „	24.400 „
Ammonium sulphate	0.638 „	25.520 „
Superphosphate	0.698 „	20.940 „
Potassium chloride	0.641 „	11.217 „
Potassium sulphate	0.665 „	11.637 „

¹ "P. and E.O.R." (1923), 334.

The lavender crop is collected from July 20th to September 1st when the flower is in full bloom. The entire inflorescences and sometimes the upper leaves are distilled. L. Lamothe has pointed out¹ that the crop should not be collected after August 15th if the finest oils are to be distilled, since subsequent to this date the oil is yellower and smells of acetic acid in contradistinction to the earlier distillate, which is paler and has more linalyl acetate.

According to this authority² the two principal lavender plants collected are sub-species of *Lavandula vera*, D.C., viz. *L. fragrans* and *L. delphinensis*. The former occurs at altitudes as low as 1300 feet and is widely distributed; the latter is found only in the higher regions. There is also a cross between *L. Spica* and *L. fragrans*. The distillers have the following designations for the various lavender species:—

1. Petite lavande—this yields the best oil and is more hardy (higher regions).

2. Lavande moyenne—yields a less fine but reasonably good oil (lower regions).

3. Grosse-lavande—yields **Lavandin Oil**.

That the composition of the oil varies according to the stage at which the lavender plants are collected has been shown by Charabot.³ By examining three samples of oil distilled when the plant was at the budding, flowering, and fading stages he was able to prove that the maximum *ester* yield is obtained when the plant is in full bloom, and also that it is higher when fading than when budding. The proportion of *alcohol*, whether free or combined, diminishes until the flowers have blossomed and at the same time the relative amount of esters increases; the oil from the mature plant with faded flowers, however, contains more alcohol and less esters.

Up to the year 1906 the universal method of extracting lavender oil was by means of water distillation in which the flowers were immersed in water, this being

¹ "Parfumerie Moderne," 18 (1925), 105.

² "Lavande et Spic," 2nd edn., Le Grand-Serre (Drôme), (1908).

³ "Comptes Rendus," 130, 257-259.



FIG. 24. Cultivated French Lavender.

(*Antoine Chiris.*

(*To face page 242.*



FIG. 25.—Wild French Lavender.

[*Antoine Chiris.*

[*To face page 243.*

heated generally by open fire and the oil carried over into the condenser with water vapours. Owing to the long period of contact between the blossoms and the water undue saponification of the esters took place. At this time Messrs. Schimmel & Co. in their Barrême works commenced the production of lavender oil by means of dry steam distillation. The process was completed much more rapidly by this means with a saving in esters of up to 10 per cent. This firm was able to produce lavender oils having an ester content of about 50 per cent,¹ the yield of oil from the fresh flowers being 0.8 per cent and from the dried blossoms 1.5 per cent. Water distillation is still the principal process worked by itinerant distillers and the major portion of the oil of commerce is produced by this means. Such oils are generally more soluble than those produced by means of dry steam, since in the latter process the steam carries over resinous matter which reduces the solubility of the oil in alcohol. The larger firms, however, have up-to-date plant for steam distillation. A very excellent study comparing the properties and characteristics of the two different oils was presented to the Lavender Congress at Digne in 1921 by Messrs. Antoine Chiris and should be consulted by interested readers.² A contribution concerning the different distillation processes was also made by Messrs. Roure-Bertrand Fils.³

Through the courtesy of Messrs. Lautier Fils of Grasse, the author was able to inspect their 78 hectares of lavender at St. André-Barrême, where they have eight stills, each having a capacity of 140 kilos. Their average yield is 1 kilo of oil from 110 kilos of lavender, and in a season they distil about 6000 kilos of oil at this plantation alone. The oil from this locality is a very fine one and tests up to 50 to 54 per cent of esters. The author has also been privileged to see the large area of lavender cultivated by

¹ More recent reports indicate that by selective cultivation at Miltitz, lavender oils have been obtained containing up to 69 per cent linalyl acetate.

² See "P. and E.O.R." (December, 1921), 404.

³ See "Bulletin" (October, 1921), 58.

Messrs. Antoine Chiris at Puberclaire, together with their well-equipped distillation plant at Allemagne and Barreme. The distillery of Messrs. Roure-Bertrand Fils at Laragne is also noteworthy for its production of high ester oils.

Concerning the composition of lavender oils the following constituents have been identified : linalyl acetate, linalyl butyrate, geranyl acetate, linalol, geraniol, with their butyric, capric and valerianic acid esters, limonene, caryophyllene, *d*-pinene, coumarin, furfural, valerianic aldehyde, amyl alcohol, ethyl amyl ketone, *d*-borneol and possibly nerol and thymol. Cineole occurs in greater proportion in English lavender oil. Some years ago a controversy arose over the statement by a London chemist that the principal ester in lavender oil is linalyl butyrate ; this assertion so far having been made without any supporting conclusive chemical proof. From the tests made by French and American chemists it is quite clear that the important ester in lavender oil of authentic origin is linalyl acetate, which ester has for many years been the acknowledged principal.

When lavender is extracted with petroleum ether about $2\frac{1}{2}$ per cent of crystals separate from the concrete on standing aside for a prolonged period. Until recently this was thought to consist entirely of coumarin, but has now been shown by A. St. Pfau¹ to be mainly a lactone identical with umbelliferone-methyl ether (7-methoxy-coumarin). Some further investigations of lavender *absolute and concrete* have been made by Volmar and Thurkauf² who are of the opinion that the tenacity of odour of these products is due to a mixture of the above-mentioned body with coumarin and coumaric acid, none of which are present in the distilled oil. Numerous bodies have been used from time to time as adulterants of lavender oil, among which may be mentioned the oils of turpentine, cedar, gurjun, alcohol, resin, terpinyl acetate, and glyceryl triacetate. The principal adulterants to-day, however, are acetylated lavandin and Ho oils. Many oils are "blended" with lavandin and spike. While lavender oils are sold on their ester content (except

¹ "P. and E.O.R." (1927), 205.

² "Jour. de Pharm. et de Chem.," T. xv., pp. 199-204.

English) it is interesting to note that the late G. Blanc, of the firm of Messrs. Lautier Frères, has shown¹ that the bouquet has no relation whatever to the ester percentage, and moreover, it is the custom of all perfumers to make their final selection when buying by means of olfactive tests.

In recent years lavender has been cultivated at Kalofer in Bulgaria where the distillers hope the industry will one day reach important proportions. During the author's visit to Italy in 1938 he discovered 10 hectares of *Lavandula vera* growing at the village of Aspromonte at an altitude of 1300 metres. This area was ultimately to be increased to 50 hectares.

It is probable that all English lavender oil and from 5 to 10 per cent of the finest French oils find their way into Lavender Water, Eau-de-Cologne and high-class perfumes. The remainder is used in the soap industry. The former are dealt with at length in the monograph on Toilet Waters in Volume II. of this work, but some notes on the latter may be of use here.

Lavender oil alone is entirely without value in toilet soaps and it is only by very skilful blending that its delightful perfume is fully developed. For this purpose the following substances are of value: borneol, bornyl acetate, musk xylene, patchouli, bergamot, rosemary, thyme, cananga, benzyl acetate, and coumarin. Quantities of spike lavender oil are invariably added, and in cheaper soaps the normal oil practically disappears. By experimenting on the following lines excellent lavender bouquets may be produced:—

250	Lavender oil.
250	Spike oil—French.
100	Geranium oil—Spanish.
100	Bergamot oil.
80	Rosemary oil.
30	Red thyme oil.
10	Patchouli oil.
70	Benzyl acetate.
10	Borneol.
50	Coumarin.
50	Musk xylene.

1000

¹ "American Perfumer" (1922), c. 122.

Spike-lavender Oil is distilled from the flowers of *Lavandula Spica*, D.C. (*L. latifolia*, Vill.), plants of the N.O. Labiatae widely distributed over the lower Alps of France at altitudes not exceeding 2000 feet, on the mountains of Spain and also Dalmatia. The blossoms appear about three weeks later than those of true lavender, the plant is taller and consequently easier of collection. The herb cutters are prone to increase the weight by admixture with other plants such as *Calamintha officinalis*, Manch., etc., which admixture is very difficult to separate. The yield of oil is about 0.5 per cent, that prepared by steam distillation being superior to that distilled in the naked fire stills.¹ It is brownish-yellow in colour and has a camphoraceous odour reminiscent of rosemary and lavender. Spike oil contains camphor, borneol, linalol, camphene, cineol, and probably terpineol. The French oil has a much finer odour than the Spanish and consequently commands a higher price. Both oils are largely used in the soap industry (see above). Commercial samples are frequently adulterated with rosemary, sage, and turpentine oils.

Lavendol is stated to be impure linalol.

Lawang Oil is distilled from a species of *Cinnamomum* found growing in the Dutch East Indies. It has a clove type odour and is reminiscent also of sassafras or nutmeg. This is probably due to a high eugenol content. Lawang is the name given to the trees by the Malays and the oil is now available from a well-known Dutch firm.

Lawsone is the pigment present in henna.

Lawsonia Inermis—see Henna.

Lecithin is present in egg yolks to the extent of about 8 per cent or double this amount in the dry state. At one

¹ See the paper by Tedesko, "P. and E.O.R." (1927), 44.

time it was prepared exclusively from this source, but is to-day obtained at a much cheaper price by extraction from soya beans. Animal lecithin is blackish-brown in colour, while that from vegetable sources is lighter and in solution is golden in colour. It is used in some skin creams and will keep quite well in any vegetable oil. When mixed with aqueous emulsions it should be preserved with one of the esters of *p*-hydroxy-benzoic acid. It is now used in hair and skin cosmetics in combination with cholestrin (*which see*). Lecithin has been the subject of a comprehensive study by Josef Augustin¹ and reference to this should be made by those who are interested.

Lemonal is a pseudonym for linalyl acetate.

Lemon-grass Oil is obtained by distillation from two different species of *Cymbopogon* grasses, viz. *C. flexuosus*, Stapf., found growing wild in the southern parts of Madras (particularly the Malabar, Travancore, and Tinnivelli districts) and also largely cultivated there; and *C. citratus*, Stapf., found wild and also cultivated in most tropical countries, particularly Ceylon, Java, the Straits Settlements, West Indies, and the Malay peninsula. In the latter, the grass is grown on a very large scale near Singapore for cookery purposes as well as for distillation. According to Werner Reinhart² the grass requires a good deal of moisture, but does not flourish in places where the rain-water cannot percolate the soil; the cultures are mostly found in India in the lower spurs of the Ghats. The districts which are of the greatest importance for the distillation of oil are the back country of Anjengo, the hilly borders of Periyor river in Travancore and the plantation districts of Peermade in Travancore and Nellampatty in the State of Cochin. The distillation of the oil begins shortly after the commencement of the rainy season, about the beginning of July, and continues according to the course of the monsoon which follows the South-West

¹ "American Perfumer" (Sept., 1932), 367.

² "Report" of Schimmel & Co. (October, 1910), 77.

monsoon, until early in January. But as on the west coast the North-East monsoon is usually very scanty and often remains altogether absent, it is generally necessary to stop distilling early in January owing to the drought which then sets in. The dried grasses are therefore burnt, since the ashes make an excellent manure. According to Reinhart the stills are housed in bamboo structures covered with straw. They are of copper, about 6 feet high and 3 feet in diameter, erected on a stone hearth. The charge of lemon-grass weighs about 700 lbs. and is placed in the apparatus tied in bundles. About 40 gallons of water are added, the still closed and connected with a worm condenser, and a fire lighted in the hearth. A charge requires 5 or 6 hours for distillation and yields about 22 ounces of oil. This is allowed to stand aside for some time to separate any water—it is transferred to drums at the port of shipment. These oils, distilled from *Cymbopogon flexuosus*, Stapf., differ from other lemon-grass oils in that they generally contain a higher citral content and are more soluble in 70 per cent alcohol.

Lemon-grass oil is of a pale sherry colour with a fragrant lemon-like odour, resembling, but not so fine as, the true verbena. It contains about 80 per cent citral, together with citronellal, geraniol, methyl-heptenone *n*-decylc aldehyde and probably linalool. This oil is used in the manufacture of ionone, in soap perfumery and as a powerful and cheap odour for hair oils, bath crystals, etc. As a verbena soap compound it may be employed thus :—

400	Lemon-grass oil.
150	Citronella oil—Ceylon.
100	Bois de rose oil.
100	Bergamot oil.
200	Lemon oil.
50	Musk ambrette residues.
<u>1000</u>	

Lemon Oil is a bright yellow liquid of pleasant odour obtained by expressing the peel of the nearly ripe fruit of



[W.A.P.]

FIG. 26.—Sicilian Lemon Trees.

[To face page 248.]



FIG. 27.--Lemon Trees attacked by Mal-Secco Disease at Roccalumera, Sicily.
[W.A.P.
[To face page 249.

Citrus medica, L., var. β -*Limonum*, Hooker filius, a small tree of the N.O. Rutaceæ. According to the researches of Fluckiger and Hanbury¹ it is probably a native of the forests of Northern India where it occurs in the valleys of Kumaon and Sikkim. The lemon was introduced to Europe by the Arabians probably first into Sicily or Spain and thence to the south of France and Italy. It is cultivated to-day in all countries bordering on the Mediterranean, but the principal seat of the lemon oil industry is in Sicily and the Calabrian belt. The tree was grown in California in 1887 and a healthy industry is now well established there, while in Australia experiments are being conducted and samples of oil have already reached this country.

In Italy the fruits are collected from November to March or April, whereas at Palermo the harvest is later and may continue to June. The principal areas of production lie on the eastern and northern coasts of Sicily and extend from Palermo in the north-west to Catania in the south, with Messina as the centre. On the east side, and north of Taormina, the mountains fall precipitously to the sea and the plantations are therefore in a narrow strip along the coast. South of Taormina and, in spite of the mass of Etna, they stretch further inland but seldom more than a kilometre. The trees attain a height of 12 to 15 feet and bear enormous quantities of fruit. Sometimes fig trees are grown on the same plantation. The lemon tree is subject to a fungoid disease known as mal-secco which enters the stomata on the under side of the leaf and can be stopped only by cutting off the branch. Its passage is indicated by a brown colour on the branches. At present it is ripe in the plantations near the village of Roccolamera, 30 kilometres south of Messina. Lemon oil is produced on an industrial scale only by Sandersons at their large factory in Tremestieri, just outside Messina, where they are said to work 50 per cent of the entire production. Here both sponge-pressed and

¹ "Pharmacographia" (1879), 114.

machine oils are made. As in the case of bergamot the main difference in the characters of the oil is due to contact with water, which if left any period causes the oxidation of the citral into one of the terpineols.

The fruit is never worked whole, as in the case of bergamot, owing to its elliptical form. Small boys and girls cut the fruit into halves with extraordinary dexterity and speed. They are known as Tagliatrice. Women called Cavatrice then scrape out the pulp in one piece with a specially shaped knife known as a Rastella. The peels are then steeped in cold water for five minutes and, after draining, stood aside for twenty-four hours in the winter and twelve hours in the summer. This increases the turgidity of the cells and enables the oil to be more easily expressed. Men known as Spomatore sponge-press the peels with great rapidity. They sit on low stools with an earthenware bowl between their legs. The sponge is held on a wood bar running across the centre and the peel turned three or four times to express most of the oil. Occasionally the treated peels are tested for good pressing. They are held near a lighted candle and squeezed. If any quantity of oil is left it burns brightly in the flame. The sponges are frequently squeezed to eject the oil, which is stood aside and decanted, being subsequently filtered. A small mechanical adaption of this principle is worked by girls. The lemon pulp is pressed for the juice, which is ultimately converted into citric acid and pectin. When the juice is required for cordials the lemons are cut longitudinally and expressed before being treated for oil. Mechanically produced lemon oil is made in a special machine or a modification known as Morasca, Cannavo, etc. Here the peels prepared as above are fed into a hopper under which runs an endless metal or wood chain some nine inches wide. The distance between the endless chain and the outer part of the machine narrows until the pressed peels are ejected. Water is sprayed on them continuously so that an emulsion of the oil and water runs from the base of the machine into a series of tanks, the oil ultimately floating to the top. Separation is accelerated

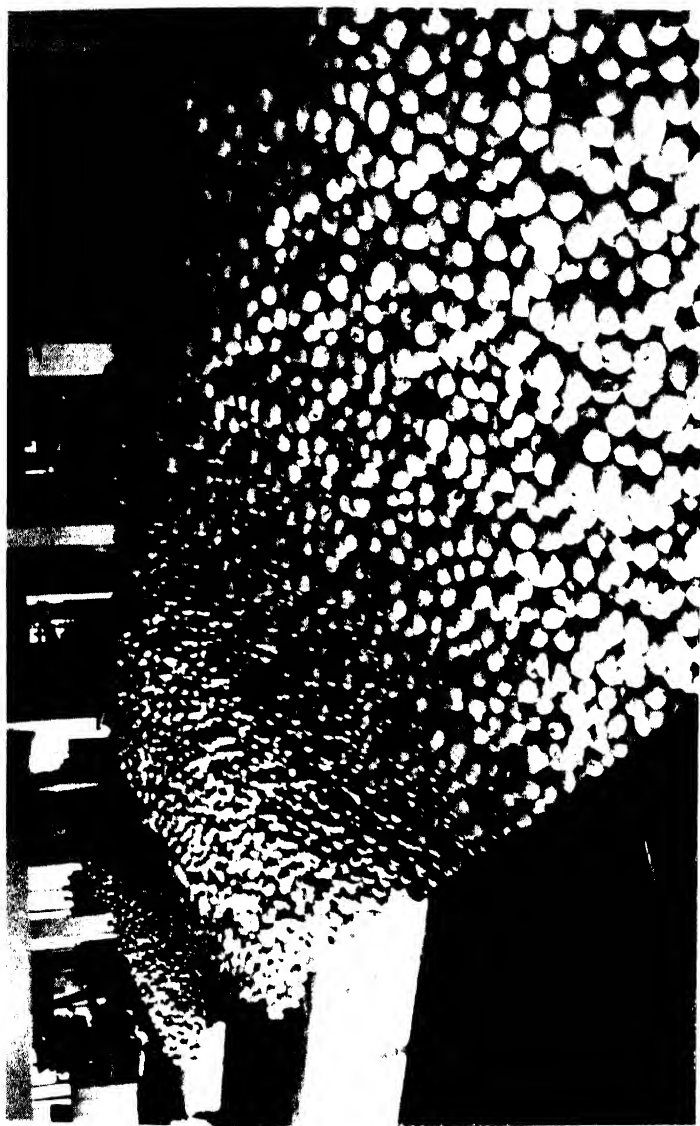


FIG. 28.—Stock of Lemons at Sanderson's Factory, Messina.

[W.A.P.]

[To face page 250.]



[W.A.P.]

FIG. 29.--Lemon Pressing by the Sponge Process at Sanderson's,
Messina.

[To face page 251.]

by the presence of traces of sodium bicarbonate or sulphate. This method of separation is used by the small producers who cannot afford a centrifugal separator. They are lax in their methods and for every day they leave the oil in contact with the water, lose $1/10$ per cent of citral.

The small producers occupy very old and dirty buildings and sometimes disused houses in the main streets of the villages which abound along the coast. A number of machines are in evidence but hand pressure is the main source of the oil. Other than Sandersons, the well-known brands are merely dealers who buy from the small producers and bulk the oil. Machine oil is darker in colour than the other. At the beginning of the season a good hand-pressed oil should contain 5 per cent of citral. Machine-pressed oil rarely contains more than 4.5 per cent, later in the season this drops to about 4 per cent.

The oil yield is 0.4 to 0.5 per cent.

The principal constituent of lemon oil is the aldehyde **citral**, which is present to the extent of 4 to 6 per cent, the remainder consisting of *d*-limonene with traces of aldehydes, C_8 and C_{10} , citronellal, methyl heptenone, phellandrene, terpineol, linalyl and geranyl acetates, etc. The principal adulterants of this oil are the terpene residues obtained during the manufacture of concentrated oil. It is well known that essence of lemon is prone to deterioration on keeping, especially if exposed to air and light. To reduce this to a minimum the oil should be stored in well-filled, air-tight containers.

The terpeneless oil is about sixteen times concentrated, and contains about 50 per cent of citral and about 20 per cent of esters in genuine oils. It is not unusual to find added citral from lemon-grass oil and also linalyl acetate, but the presence of the former is generally evident to a keen sense of smell. An unadulterated oil is soluble in four to five volumes of 78 per cent alcohol.¹ This oil is useful up to about 0.1 per cent in artificial rose ottos. Lemon oil finds a wide application in the soap industry, and will

¹ See Dalton's paper, "P. and E.O.R." (1928), 7.

often replace bergamot oil, with a pecuniary saving. It is, however, prone to resinify within about 14 days of its incorporation in the soap. This can be prevented very largely by the addition of about 10 per cent of a fixative having a boiling-point not lower than 250° C. Lemon oil blends well with benzyl acetate, palmarosa, clove, and geranium oils, and is much used in conjunction with citronella and lemon-grass oils as a verbena perfume. In Italy lemon oil is frequently used as a substitute for oil of turpentine.

Lentisk—*see* Mastic.

Liatris Concrete has been prepared on an experimental scale in Grasse from the leaves of *Liatris odoratissima*, Willd., a herb belonging to the N.O. Compositæ and indigenous to the Southern States of North America. It occurs as a dark green crystalline mass having a pronounced odour of coumarin type.

Licareol is the name originally given by Morin to *l*-linalol obtained from bois de rose oil.

Lichenol—*see* Oakmoss and Iso-propyl Quinoline.

Lignum Aloes—*see* Aloe-wood Oils.

Lilac perfumes are usually mixtures of synthetics with the odour of terpineol predominating. This is backed up with phenylethyl alcohol, anisic alcohol, and hydroxycitronellal and crowned with a small percentage of natural jasmin. The absolute has been prepared on an experimental scale, but its odour lacked all the characteristics of the fresh flower.

For further details reference should be made to the monograph on Lilac in Volume II.

Lilacine is a name given to terpineol, alone or mixed with linalol, heliotropin, etc.

Lily—Perfumes are invariably mixtures of synthetics with the predominating odour of hydroxy-citronellal (known as lily aldehyde). In combination with linalol, terpineol, and small quantities of jasmin, a delightful lily perfume is obtained.

A detailed account of the Lily will be found on reference to the monograph in Volume II.

Lime Blossom—*see* Tilleul.

Limes Oil of commerce is imported principally from Montserrat,¹ in the West Indies, where it is obtained, both by expression and distillation, from the rind of *Citrus medica*, L., var. *acida*, Brandis., N.O. Rutaceæ. The trees are grown from seedlings and the first crop of fruit is gathered after 5 years. The yield is at its best about the tenth year and the trees bear fruit for about 40 years. The principal crop is from June or July to November or December. The fruit requires about six months to attain maturity, the yield amounting to about ten tons per acre. The distillation process yields an oil of inferior odour resembling turpentine, and due probably to the presence of traces of **Cymene**. This results from the decomposition of citral and is unavoidable, since the main article for export is *lime juice*, and during its concentration the organic acids present react on the oxygenated constituents of the oil, which is afterwards separated from the aqueous distillate. Another oil, *i.e.* Italian **limette oil**, is only occasionally met with, and is obtained solely by expression from the peel of *Citrus limetta*, Risso., N.O. Rutaceæ. These oils contain up to about 25 per cent of linalyl acetate, together with citral, linalol, and limonene. A yellow deposit is thrown down on standing and is known as **Limettin** (this is absent from the distilled oil). Genuine limette oil is practically unknown.

The lime tree is also indigenous to India, but in the Bombay Presidency some 1200 acres are under cultivation.

¹ Of late years the industry has developed rapidly in other West Indian Islands and in British Guiana.

While the fruit is available throughout the year, the principal crops are collected from July to September and also in December. The limes are minced and the pulp distilled mainly at Utran in the East Khandesh district of the Presidency.

Lime oil is, of course, much used as a flavouring agent, and in recent years has been employed in place of lemon oil in eau-de-Colognes, especially when they contain coriander. Citral from lime oil is obtainable, and 0.1 per cent of it is useful for producing a delightful freshness in almost any floral compound.

E. J. Parry¹ has examined an oil distilled from the *flowers* of the Italian lime tree, in which he found linalol and methyl anthranilate.

Limonene, $C_{10}H_{16}$, is a hydrocarbon occurring in many essential oils, notably in those of lemon, orange, and bergamot. It is a colourless or pale yellow liquid of sweet lemon-like odour, and is useful in preparing cheap artificial neroli or mandarin oils. **Dipentene** is the racemic form of the optically active *d*-limonene and *l*-limonene.

Linaloe Oil is a colourless to pale yellow liquid of pleasant odour, and is obtained by distillation from the wood of species of the family Burseraceæ widely distributed throughout Mexico. Owing to keen competition with the Brazilian oil, to say nothing of the cheaper Ho oil, this has now practically disappeared from commerce. According to the observations of Seyffert and Altamirano² there are two different species closely resembling each other and called in Spanish *Linaloe* and *Copal limon*. The former has almost disappeared, while the natives distinguish three kinds of the latter according to their external appearance and odour: fine, common, and caraway linaloe. Fine linaloe has a very delicate and pleasant odour, the common kind less so, and the third resembles caraway. Copal limon

¹ "Chemist and Druggist," 56 (1900), 993.

² "Report" of Schimmel & Co. (October, 1907), 59.

yields nearly all the oil of commerce, it is very hardy and grows well in stony soil. Oil is only distilled from it after about 20 years' growth and this is said to be mixed with the oil from the fruits which give a higher yield. The best oil, however, is obtained from trees 40 to 60 years old—in younger trees the yield is increased by cutting notches in the trunk. The most aromatic part is the "heart" wood, and before the trees are cut down they are deeply incised and examined for this. If no "heart" wood has developed, the incisions are left and in a very short time the wood becomes saturated with oil—such being probably a pathological product.¹ This operation is carried out in April and September, and distillation of the chipped wood in December and June. The yield is about 2.5 per cent. The stills hold about 5 hundredweights of chips and are heated by direct fire. One charge requires from 18 to 20 hours for distillation. Mexican linaloe oil contains up to 76 per cent of linalol together with geraniol, terpineol, methyl heptenol, etc.

Linalol, $C_{10}H_{17} \cdot OH$, occurs in the free state in cayenne, Brazilian and Mexican linaloe and Ho oils and in the form of esters in numerous essential oils, notably in those of lavender, bergamot, petitgrain, clary sage, neroli, basil, and rose. It is isomeric with geraniol and nerol. This alcohol is a colourless liquid with a soft, sweet odour and is obtained in a nearly pure state by fractional distillation. S.G., 0.870; B.P., 198° C. It was formerly named *Licareol* and is useful in the preparation of numerous artificial floral oils. In particular, linalol from bois de rose oil, which is the finest, enters the composition of lily, lilac, honeysuckle, sweet-pea, rose, and neroli.

Linalyl Acetate, $CH_3 \cdot COOC_{10}H_{17}$, is found naturally in numerous essential oils, and, in addition to those mentioned under linalol, it has been identified in the oils of jasmin and

¹ According to W. C. Slater ("P. and E.O.R." (1922), 12), who has more recently visited Mexico, the trees are cut down without regard to age or maturity.

gardenia. It may be prepared artificially by the action of acetic anhydride on linalol and is the most important ester. Linalyl acetate is a colourless oil, and in some samples the bouquet is almost identical to that of terpeneless bergamot oil. S.G., 0.910. This ester is also useful in many other artificial perfumes, such as jasmin, syringa, tilleul, ylang-ylang, and cheap Cologne. It is invaluable in soap perfumery.

Linalyl Anthranilate, $\text{NH}_2 \cdot \text{C}_6\text{H}_4 \cdot \text{COOC}_{10}\text{H}_{17}$, is a yellowish-brown semi-viscous liquid having an intense odour of orange blossom type. Its manufacture is extremely difficult and the product very unstable. It is much appreciated in synthetic neroly, orange blossom, and jasmin.

Linalyl Benzoate, $\text{C}_6\text{H}_5 \cdot \text{COOC}_{10}\text{H}_{17}$, is a yellowish to brownish oily liquid having a heavy odour recalling that of the flower of broom and tuberose. It is used as a blender in such perfumes and also in semi-heavy bouquets of Oriental type. S.G., 0.8909. The preparation of this ester is difficult and it is prone to ready decomposition. As a rule the lighter coloured oils have the finer odour and are incidentally more stable.

Linalyl Butyrate, $\text{C}_3\text{H}_7 \cdot \text{COOC}_{10}\text{H}_{17}$, is an oil having a characteristic butyraceous odour resembling citronellyl butyrate but more sweet and flowery. It occurs naturally in French lavender oil, and is useful for blending in that type of perfume. Linalyl butyrate deserves a much more extended application in modern perfumes. S.G., 0.9289.

Linalyl Cinnamate, $\text{C}_6\text{H}_5 \cdot \text{CH} : \text{CH} \cdot \text{COOC}_{10}\text{H}_{17}$, is a yellowish oily liquid having a sweet and persistent odour of lily-jasmin type. Remarkable effects may be obtained with it in pale coloured jasmin compounds, and it is a valuable adjunct also in tuberose and rose compositions. S.G., 0.9787.

Linalyl Formate, $\text{H} \cdot \text{COOC}_{10}\text{H}_{17}$, is a liquid having a fine bergamot-like odour. It has great possibilities as

a sweetening constituent of perfumes. S.G., 0.919; B.P., 190° C.

Linalyl Iso-Butyrate, $(\text{CH}_3)_2 \cdot \text{CH} \cdot \text{COOC}_{10}\text{H}_{17}$, is a liquid having a much richer odour of the lavender type than the normal butyrate. It is useful in artificial lavenders, etc. S.G., 0.893; B.P., 110° C. at 5 mm.

Linalyl Phenylacetate, $\text{C}_6\text{H}_5 \cdot \text{CH}_2 \cdot \text{COOC}_{10}\text{H}_{17}$, is a brownish-red liquid, manufactured with great difficulty and is comparatively unstable. It should, therefore, be used when freshly prepared. It has a fine fougere odour and blends remarkably well with all types of coumarin compounds.

Linalyl Propionate, $\text{C}_2\text{H}_5 \cdot \text{COOC}_{10}\text{H}_{17}$, is an ester of the coriander-lily-bergamot type. It may be employed in this capacity and also for imparting freshness to eau-de-Colognes, jasmynes, and synthetic clary sages. S.G., 0.915; B.P., 115° C. at 10 mm.

Linalyl Valerianate, $\text{C}_4\text{H}_9 \cdot \text{COOC}_{10}\text{H}_{17}$, occurs naturally in the oils of sassafras leaves and French lavender. It is a liquid having a peculiar, somewhat fruity odour suggestive of apricots—specific gravity, 0.9011, and may be successfully employed in tobacco flavours of which an example is appended:—

300	Linalyl valerianate.
200	Geranium oil—Spanish.
100	Cassia oil.
100	Clove oil.
50	Nutmeg oil.
50	Caraway oil.
70	Cascarilla oil.
10	Vanillin.
120	Coumarin.
1000	

Linden Blossom—see Tilleul.

Lippia—see Verbena Oil.

Liquidambar is the oleo-resinous secretion found in
VOL. I.

small excrescences on the bark of *Liquidambar Styraciflua*, L., large and beautiful trees of the N.O. Hamamelideæ found growing in vast forests at high altitudes in the mountains of Honduras. The crude balsam is purified by solution in volatile solvents, filtration, and subsequent removal of the solvent. It is a viscous, transparent, pale amber liquid having a clean, aromatic balsamic odour. It is known as sweet gum, Honduras balsam, and white Peru balsam. Chemical examination has shown it to contain cinnamic acid free and as ester, cinnamic alcohol, phenyl-propyl alcohol, hydrocarbons and a sesquiterpene. Liquidambar bears some relationship to styrax, but the odour is sweeter and more aromatic. It is an excellent constituent for jasmin compounds and for numerous soaps. (*Compare also Styrax.*)

Liquor Ammon Fort—see Ammonia.

Litsœa Oil—see May Chang Oil.

Locust Bean Gum—see Carob Seed Gum.

Logwood is the heartwood of *Hæmatoxylon campechianum*, N.O. Leguminosæ, a tree growing in Honduras, Jamaica, etc. The principal constituent is *Hæmatoxylín*, which occurs to the extent of about 10 per cent and is used as a dye.

Longosa Oil is probably obtained from the flowers of *Hedychium flavum*, cultivated plants of the N.O. Scitaminæ found on the island of Nossé Bé, a few miles north-west of Madagascar. The blossoms appear during February and March, and the harvest is collected during 3 or 4 weeks. Picking takes place in the early morning in order to avoid the intense heat of the sun. The flowers are extracted with petroleum ether and yield only 490 grams of concrete from 1000 kilos. This is a semi-solid mass of dark colour due probably to the interaction of phenols and nitrogenous substances contained therein. The yield of absolute from concrete is about 50 per cent and is dark orange-brown in colour. 22 per cent of straw-yellow oil was obtained by steam

distillation by Trabaud and Sabetay,¹ who were able to detect the presence of indole and possibly also of methyl anthranilate. An oil examined by the author had a typical exotic fragrance of peppery character backed by an odour reminiscent of ylang, jasmin, orange blossom and tuberose.

Lonicera—see Honeysuckle.

Lorenerol—see Nerol.

Lotos is an ancient Egyptian name for a plant growing in the Nile, of which the Greek historian, Herodotus (B.C. 413), who visited Egypt, says: "When the river swells, great numbers of lilies, which the Egyptians call lotos, shoot up through the water. These they cut down, and after they are dried in the sun, take out the heart of the plant, which resembles a mekon (poppy); they mould it into paste and bake as bread. They likewise eat the lotos (the tuberous root), which is round, and equal to an apple in bigness." This appears to be the *Nymphaea lotus* of Linnæus, the white water-lily of Egypt, the representative of the white water-lily of this country, *Nymphaea alba*. Lotos perfumes are mixtures of linalol and phenylethyl alcohol with traces of patchouli and undecalactone, suitably fixed with amber and benzoin R. (see also *Nelumbium speciosum*).

Lotus Jacobea is a small shrub, native of Cape Verd, remarkable as being one of the few plants that have truly black flowers.

Lotus Odoratus and **L. Corniculatus**, commonly called birdsfoot trefoil, are varieties of clover, with faintly perfumed yellow blossoms. The seed pods are exactly like a bird's foot, hence their common name.

Lotus Perfumes are always creations of fantasy. They are frequently of the heavy lily-ylang type and can be blended on the lines indicated in the Lily monograph in Volume II.

¹ "P. and E.O.R." (1938), 142.

Lovage Oil (in French *Liviche*) is a yellow viscous liquid obtained by distillation of the whole plant of *Livisticum Officinale*, Koch, N.O. Umbelliferæ, and having a decidedly heavy and persistent odour reminding one of a mixture of angelica or celery and oakmoss. On evaporation a peculiar animal character is evident which is reminiscent of the true opoponax. The chemistry of the oil is by no means complete, and so far terpineol is the only constituent identified with certainty. According to G. Igolen¹ the yields of oil are :—

From the fruit	0.8 to 1.1 per cent
„ „ fresh herb and inflorescence	0.5 „ 1.5 „
„ „ entire plants	2.48 „
„ „ roots	1 to 10 „

The latter oil was found to have the highest olfactory value. Lovage oil has a limited use in perfumery and in a few tobacco flavours.

Lycopodium is a pale yellow, mobile and odourless powder. It consists of the spores of the common club moss *Lycopodium clavatum*, L., and probably other species of the N.O. Lycopodiaceæ, creeping plants indigenous to the continents of Europe, Asia, and North America. Lycopodium of European commerce is generally obtained from Russia where the spores are collected during July and August by shaking the plants. Impurities are subsequently removed by sifting the powder through a fine mesh. It contains about 50 per cent of fixed oil together with some glyceryl myristate. Lycopodium is used in dusting powders owing to its soothing influence on the skin. It is an unique constituent of face powders.

Maali Resin is a soft, yellowish-white substance resembling elemi and is exuded by an unknown Samoan tree. It is used by the natives as a dressing for the hair and also for embalming. The resin was subjected to distillation by Schimmel & Co.² who obtained 16 per cent

¹ "Les Parfums de France" (1936), 70.

² "Report" (November, 1908), 137.

of a light green oil which solidified at normal temperature. It had a balsamic odour reminiscent of tea roses.

Macassar Oil is a yellowish, butter-like oil having an odour reminding of benzaldehyde. It is obtained by expression from the seeds of *Schleichera trijuga*, Willd., a plant belonging to the family Sapindaceæ and native of the Sunda Islands in the East Indies. In this part of the world the oil has a great reputation as a dressing for the hair and for removing scurf and eczema. Whether this oil, or that obtained from safflower seeds (*Carthamus tinctorius*, N.O. Compositæ) entered the preparation of the once popular macassar oil of the Western Hemisphere, is a matter of conjecture.

Mace Oil is the essential oil distilled from the arillus of the nutmeg. It closely resembles oil of nutmeg (*which see*), but contains a larger proportion of oxygenated constituents. It is doubtful if the true oil, from the arillus only, is met with in commerce. Mace oil is occasionally used in soap perfumes of the santal type.

Magnesium Carbonate, $MgCO_3$, is obtained in the *light* form by precipitating a solution of the sulphate with a solution of sodium carbonate. It occurs as a flocculent white powder and is used in the manufacture of face powders and dental preparations. It is also employed as a "carrier" for perfumes intended for face powders. The compound is added to sufficient magnesium carbonate to make a fairly dry powder. This is sifted and stored in bottles or lined bins. A known weight is then added to the bulk face powder, and more even distribution of the perfume is thus ensured in the mixing machine.

Magnesium Peroxide, Mg_2O_2 , is prepared by adding a solution of hydrogen peroxide to calcined magnesia. After standing for some hours the residue is filtered out, washed and dried. It contains from 15 to 20 per cent of true magnesium peroxide and is used in dentrifices.

Magnesium Stearate, $(\text{CH}_3 \cdot (\text{CH}_2)_{16} \text{COO})_2 \text{Mg}$, is a recognised constituent of several cosmetics. Its properties resemble those of zinc stearate (*which see*), excepting that it appears to be free from the risk of poisoning when applied to the skin. In general it is preferable to use this stearate and so eliminate any possibility of trouble. It is an indispensable constituent of modern toilet powders, to which it imparts added adherence and is incidentally a useful constituent for giving "waterproofing" qualities.

Magnesium Sulphate, $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$, although well known as a saline purgative, has found application in cosmetics, largely through the assumption that it exerts a similar action through the skin when used in bath salts, etc. In this direction it has been used as a constituent of reducing salts and is a well known remedy for jockeys having a tendency to put on weight. Solutions of Epsom salts give some relief to insect bites, and it is also used as a constituent of sunburn, deodorant, and toning lotions.

Magnolia is the name of a genus of trees and shrubs native to China, Japan, and North America. The flowers are delightfully fragrant and have given rise to artificial oils of this name, which usually consist of jasmin, neroli, and rose, with traces of ionone and benzaldehyde—for further details reference should be made to the monograph in Volume II.

Maize Starch is obtained from the fruits of *Zea mays*, L., a plant belonging to the N.O. Graminaceæ, and largely cultivated in subtropical countries. The cells containing the starch grains are ruptured by grinding the softened fruits to a pulp. They are then washed out with a weak solution of alkali, the latter being added to dissolve the gluten. The starch is further purified by washing, straining, etc., and finally dried. The moist granules gradually separate into angular fragments and when quite dry are powdered. Maize starch is used in face powders, rouges, and numerous other cosmetics, but generally that obtained from rice is preferred.

Male Fern Resin is obtained by the volatile solvent process from the dried rhizomes of a *Dryopteris Felix-mas*, Schott., ferns belonging to the N.O. Felicineæ and indigenous to Europe. The rhizomes are collected late in the autumn and the roots, leaves, etc., removed to facilitate drying. The resinoid is a greenish-brown semi-liquid substance having a characteristic heavy and persistent odour. The principal constituent is a substance called *filmarone* to which the male fern owes its properties as a vermifuge. Male fern resinoid is an excellent fixative base for Oriental and fern bouquets.

Mandarin Oil is obtained by expression from the peel of the fruit of *Citrus madurensis*,¹ Laur., a small tree of the family Rutaceæ found mainly in Calabria where the season is in October and November. Trees are now being planted in Sicily as a resistant to the lemon tree disease referred to under that heading. One tree produces about 1000 fruits per annum and these yield about 400 grams of a bright golden-yellow oil. It is expressed in the same manner as lemon oil but the remaining pulp has no market value. Mandarin oil has a fragrant odour reminding of sweet orange oil and contains methyl-methyl anthranilate together with large proportions of *d*-limonene. It is sometimes used in the preparation of eau-de-Cologne.

Marigold Oil—see Taget Oil.

Marjoram Oil is obtained by distillation from the sweet marjoram, *Origanum majorana*, L., a herb attaining a height of about 1 foot and belonging to the N.O. Labiatae. It is grown in Spain, in some parts of Southern France and in other countries bordering on the Mediterranean. During the last few years it has been cultivated also at Sfax in Tunis. Marjoram oil is generally colourless, but may have a yellowish tinge and possesses a tenacious odour reminiscent of nutmeg and mint but quite characteristic. It is

¹ According to Berte and Gulli ("Y.B.P.," 1906, 49) the oil is also expressed from *C. deliciosa* and *C. bigaradia sinensis*, and is subject to adulteration with orange and lemon oils.

often confused with thyme and organum oils, but differs from these in that it consists largely of terpenes whereas they contain phenols. True sweet marjoram oil can be obtained from a few firms in the south of France where they cultivate small quantities of the herb.

Much confusion has existed in regard to this oil, and is probably due to the vernacular names of the parent plants. In France *Originum majorana* and *O. vulgare* are both designated *marjolaine*, the former, however, is distinguished as *douce* and the latter as *sauvage*. Further, in the neighbourhood of the Alpes maritime, *Calamintha nepeta* is often called *marjolaine* instead of *Calaminthe nepete*. In England *Origanum vulgare* is known as *wild marjoram*, while in Spain *Thymus mastichina* is called *wood marjoram*. Sweet marjoram was grown as a pot herb by the ancient Egyptians and has been used in perfumes and unguents from early times. To-day it is little used, only occasionally being employed for perfuming hair pomades.

Marocaine Oil is distilled probably from a species of *Pelargonium* at present unidentified. Some time ago it was offered by a well-known Paris firm who were unable to give the author any details of its source. At normal temperatures the oil is semi-solid and contains a large proportion of stearoptene. Its odour recalls a mixture of Algerian geranium and rose otto. (*Compare also Zdravets Oil.*)

Marsh Rosemary Oil is distilled from *Ledum palustre*, L., N.O. Ericaceæ, a herb grown in Silesia. Messrs. Schimmel & Co.¹ obtained a yield of 0.33 per cent of a lemon-yellow oil which recalled the odour of coriander and worm seed oils.

Mastic is a hard, resinous exudation obtained by incision from the bark of the stem and branches of the broad-leaved variety of *Pistacia lentiscus*, L., a small tree of the N.O. Anacardiaceæ, indigenous to the countries bordering on the Mediterranean. The mastic of commerce is collected principally in Scio and Cyprus. It occurs in rounded,

¹ "Report" (1919), 35.

irregular, or pear-shaped tears of a white or pale yellow colour, either opaque or glassy in appearance. It has an agreeable balsamic odour, recalling turpentine, and a strong tincture is useful as a fixative in honeysuckle, lavender, fern, mimosa, and sweet-pea perfumes. About 2 per cent of volatile oil is obtainable from this resin. This is now a commercial commodity and has a penetrating leafy odour.

Matico Oil is a yellowish-brown liquid having an intense odour reminiscent of pepper, cubeb, and mint. It is obtained by distillation from the leaves of *Piper augustifolium*, R. et P., N.O. Piperaceæ. Owing to the powerful nature of its aroma it can be used to the extent of about 0.1 per cent in carnation compounds based upon pimento and iso-eugenol.

Matthiola Bicornis—see Stock.

Mawah Oil is the name given to geranium oil distilled in Kenya and South Africa from *Pelargonium graveolens*, Ait. At Njoro, in the former country, there are some 500 acres under cultivation. Kenya geranium oil is now an article of commerce and it has a fine typical geranium odour. According to E. W. Bovill,¹ Mawah and Kenya geranium oils are probably obtained from different hybrids of the above species.

May Blossom—see Hawthorn and Aubépine.

May-Chang Oil is distilled from the flowers of *Litsæa citrata*, Bl., a tree belonging to the family Lauraceæ. It attains a height of about 30 feet and is native of Tonquin, where the flowers are used for perfuming tea. The oil has a pleasant odour reminding of bois de rose and coriander and contains citral, *d*-linalol, terpineol, geraniol, and limonene, with traces of saturated aliphatic aldehydes. Should this become a commercial article it would probably find a useful employment in perfumery.

Meadow Sweet, or *Spiraea ulmaria*, L., is a common plant of the N.O. Rosaceæ found in meadows, hedgerows,

¹ "P. and E.O.R." (October, 1934), 319.

and on the banks of streams in England. The flowers possess an almond-like fragrance, which is attributed to the presence of salicylic aldehyde. An oil has been distilled from the flowers and contained salicylic aldehyde, methyl salicylate, heliotropin, and vanillin.

Mecca Balsam, also known as balm of Gilead, is now rarely met with in commerce. It is believed to be obtained by incision from *Balsamodendron opobalsamum*, Engl., N.O. Burseraceæ, and is a fragrant yellowish viscid liquid containing about 30 per cent of volatile oil. According to Schweinfurth,¹ the tree is distributed over the coast of Arabia and Southern Nubia, but the balsam is collected only in the valleys near Mecca. Minute quantities of it exude from the twigs of the tree, and Schweinfurth thinks the balsam is collected by boiling these in water. Mecca balsam is esteemed by the eastern nations as a medicine, and is stated to be used by the Egyptian perfumers for obtaining some of their Arabian blends.

Meerschaum is a hydrous form of magnesium silicate, $Mg_2Si_2O_8 \cdot 2H_2O$, occurring in irregular nodular masses in alluvial deposits, and having a greyish-white to cream colour. The word is the German for "sea-foam," and deposits are found in the United States and in various parts of Asia Minor. There appears to be some possibility of the use of powdered meerschaum in face powders in spite of its not being a dead white material. It is alleged to have good absorbent properties and to have no dermatological defects.

Melaleuca Oils have been distilled from time to time from different species of the genus *Melaleuca*, but only one of these, *M. bracteata*, F. v. Mull, appears to be of interest to the perfumer. A bright yellow oil was distilled by Baker and Smith from the leaves and twigs of this myrtaceæ, which had an aromatic odour reminding of champaca. It consisted principally of methyl eugenol, together with eugenol, cinnamic acid, cinnamic aldehyde, cinnamyl cinnamate, and *L*-phellandrene—see also Tea Tree Oil.

¹ "Year Book of Pharmacy" (1894), 170.

Melilot (*Melilotus officinalis*, Desse.) is a clover-like annual or biennial of the N.O. Leguminosæ, widely distributed throughout Europe and Western Asia. It is chiefly met with among bushes, and its fragrance, though not so powerful, resembles that of the sweet woodruff. Its odour is most noticeable when dry, and appears to be due to derivatives of coumarin. It is used for flavouring Gruyère cheese.

Melilotal is *p*-methyl acetophenone.

Melilotin is hydrocoumarin.

Melissa Oil, also known as balm oil, is obtained by distillation from the leaves and tops of *Melissa officinalis*, L., N.O. Labiatae, a herb native of the countries bordering on the Mediterranean and also cultivated in the United States. When distilled by A. Chiris¹ a yield of 112 per cent was obtained. The oil was brown in colour and no citral odour was observed. The commercial product is believed to be obtained by distilling lemon oil over the herb, citronellal in some cases being added. Schimmel & Co.² say that it may even be a fractionated citronella oil.

Menthol, $C_{10}H_{18}OH$, occurs in fine, colourless, acicular crystals, melting at $42^{\circ} C.$, and is the distinctive alcohol in oil of peppermint. It is separated on cooling from the freshly-distilled product in Japan, etc. Menthol is largely employed in medicine, and is particularly useful in dental creams for obtaining that peculiar freshness after application to the teeth. In small quantities and if well covered it will enhance the cooling properties of solid eau-de-Cologne. B.P., $212^{\circ} C.$; S.G. at $45^{\circ} C.$, 0.8810. Recently a well-known English firm has introduced successfully a synthetic menthol prepared by hydrogenating thymol in the presence of a nickel catalyst. A German firm has likewise patented a process for the manufacture of menthol from pulegone (from pennyroyal oil). Synthetic menthol has a melting-point of $37^{\circ} C.$

¹ "Las Parfums de France" (1924), 152.

² "Report" (1917), 105.

Menthone, $C_{10}H_{18}O$, is the characteristic ketone found with menthol and menthyl acetate in oil of peppermint.

Menthyl Acetate, $CH_3 \cdot COOC_{10}H_{19}$, is an ester found in peppermint oils. It is useful as a flavour, and in Cologne and lavender waters. S.G., 0.927 ; B.P., 227° C.

Menthyl Iso-valerianate, $(CH_3)_2 \cdot CH \cdot CH_2 \cdot COOC_{10}H_{19}$, occurs in American peppermint oil. S.G., 0.907.

Menthyl Salicylate, $C_6H_4 \cdot OH \cdot COOC_{10}H_{19}$, is a colourless, almost odourless liquid which has remarkably efficient filtering properties for ultra-violet light. It has found application in sun-tan oils where 10 per cent added to a vegetable oil base makes an effective product. The only drawback to its use is that of cost compared with other cheaper and equally satisfactory agents.

Menthyl Valerianate, $C_4H_9 \cdot COOC_{10}H_{19}$, is a liquid of sweet fruity fragrance. S.G., 0.907 ; B.P., 126° C. at 10 mm.

Methenamine—see Hexamine.

***p*-Methoxy-Acetophenone**, $CH_3 \cdot CO \cdot C_6H_4 \cdot OCH_3$, is a crystalline substance melting at 38° C., and having an intense flowery fragrance. Its closely allied hydroxy derivative, known as *paenol*, has been identified in nature. It is prepared synthetically and is known also as **Acet Anisol** or *anisyl-methyl ketone*. The principal use of this product is in soaps of the type, *fougere*, *trèfle*, and *mimosa*.

Methoxy-Cinnamic Aldehyde, $CH_3O \cdot C_6H_4 \cdot CH : CH \cdot CHO$, is a crystalline substance melting at 45° C. boiling at 295° C. and having an odour recalling *cassia*, in which oil it occurs naturally. Its isomer *p*-coumaric-aldehyde methyl ether has also been shown to occur in the oils of *tarragon* and *chlorocodon*.

***p*-Methoxy Phenylacetaldehyde**—see *p*-Anisyl Acetaldehyde.

***p*-Methyl Acetophenone**, $CH_3 \cdot CO \cdot C_6H_4 \cdot CH_3$, methyl *para*-tolyl ketone, is a colourless or pale yellow liquid with a very fragrant coumarin-like odour, and is

obtained artificially by condensing toluene with acetic anhydride. S.G., 1.007 ; B.P., 222° C. It is an indispensable article in the preparation of all mimosa and hawthorn perfumes and blends well with terpineol, benzyl formate, iso-butyl salicylate, oakmoss, patchouli, and rose. In traces para-methyl acetophenone is useful for giving especial characteristics to cassie bouquets. It will also effectively replace coumarin in foin coupé perfumes. An example of this is given below :—

10	Methyl acetophenone
200	Iso-butyl salicylate.
50	<i>n</i> -Butyl phenylacetate.
60	Bergamot oil.
50	Aubepine.
200	Geranium oil—Spanish.
300	Lavender oil—Mont Blanc.
50	Ylang-ylang oil.
30	Oakmoss absolute.
20	Patchouli oil.
30	Benzoin R..
<u>1000</u>	

Methyl-Amyl Carbinol is Secondary Heptyl Alcohol (*which see*).

Methyl-Amyl Ketone, $\text{CH}_3 \cdot \text{CO} \cdot (\text{CH}_2)_4 \cdot \text{CH}_3$, is a liquid of characteristic odour found naturally in clove and cinnamon bark oils. It may be prepared synthetically and is a useful substance in carnation oils. S.G., 0.820 ; B.P., 151° C.

Methyl Anisate, $\text{C}_6\text{H}_4 \cdot \text{OCH}_3 \cdot \text{COOCH}_3$, is a crystalline substance, melting at 45° C., and having a sweet odour recalling that of the aromatic herb *Anthriscus cerefolium*, Hoffm., N.O. Umbelliferæ. It is used for giving “body” to fancy perfumes, and is sometimes employed in hawthorn, mimosa, and linden blossom compositions.

Methyl Anthranilate, $\text{NH}_2 \cdot \text{C}_6\text{H}_4 \cdot \text{COOCH}_3$, is a crystalline body, melting about 24° to 25° C., and in solution has a characteristic violet-blue fluorescence. S.G., 1.168.

It possesses a sweet odour of orange flower, and is indispensable in pseudo-neroli oils. This body has been identified in many flower oils, among which may be cited neroli, ylang-ylang, jasmine, wallflower, and tuberose. When mixed with other synthetics its odour almost disappears, but on standing a few hours even small quantities become apparent. By condensation with hydroxy-citronellal a greenish-yellow viscous liquid is produced known as *Aurantiol*. As much as 15 per cent may be used in cheap artificial nerolis, as the following formula will show, but for better quality oils the addition of terpeneless petitgrain oil is desirable :—

400	Phenylethyl alcohol.
250	Linalol.
90	Linalyl acetate.
150	Methyl anthranilate.
10	Aldehyde C_{10} —10 per cent.
100	Sweet orange oil.
<u>1000</u>	

Methyl anthranilate is also much employed for blending in soap compounds. It possesses the disadvantage of turning white soaps reddish-brown with age and is therefore best in coloured soaps. A pink bouquet toilet soap can be safely perfumed with a methyl anthranilate compound as follows :—

300	Geranium oil—African.
100	Ginger-grass oil.
50	Lemon-grass oil.
50	Patchouli oil—Singapore.
50	Clove oil.
300	Bergamot oil.
50	Methyl anthranilate.
40	Styrax.
60	Musk xylene.
<u>1000</u>	

p-Methyl Benzalacetophenone, $CH_3 \cdot C_6H_4 \cdot CO \cdot CH : CH \cdot C_6H_5$, is an oil having an odour of tuberose type.

Methyl Benzoate, $C_6H_5 \cdot COOCH_3$, also known as Niobe Oil, is a colourless and powerfully odorous oil (rather harsh), prepared by passing dry HCl gas through a solution of benzoic acid in methyl alcohol. It occurs naturally in

the oils of clove, ylang-ylang, and tuberose. In combination with vetivert, oakmoss resin, and labdanum, it is useful as a base for peau d'espagne perfumes, while in traces with para-cresol methyl ether it is an important adjunct in preparing artificial ylang-ylang oil. S.G., 1.094 ; B.P., 199° C.

Methyl Butyrate, $C_3H_7 \cdot COOCH_3$, is a liquid of fruity odour. S.G., 0.904 ; B.P., 103° C.

Methyl Caprylate, $CH_3 \cdot (CH_2)_6 \cdot COOCH_3$, is a liquid ester having an intense floral-fruity odour. It is useful in traces for imparting a new note to fancy bouquets.

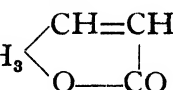
Methyl Caprylate, $CH_3 \cdot (CH_2)_6 \cdot COOCH_3$, is a colourless liquid having a powerful fruity fragrance. It is used in the same way as methyl caprylate.

Methyl Cellulose is a synthetic, non-fermentable colloid occurring on the market in compressed fibrous blocks of varying grades. It forms a jelly when stirred into boiling water and allowed to cool. These jellies are stable to all conditions other than temperature change, a sharp rise causing the methyl cellulose to coagulate and separate out. On cooling, the jelly reforms. It is not affected by weak acids, alkalies, or electrolytes, and being non-fermentable will not encourage the growth of moulds. So long as no other susceptible ingredients are mixed with it, a preservative is unnecessary. Methyl cellulose finds application in the non-greasy type of cosmetic cream.

Methyl Chavicol, $C_{10}H_{12}O$, is an aromatic liquid occurring naturally in the oils of Tarragon, fennel, anise bark, and bay. It is occasionally used in soap perfumery.

Methyl Cinnamate, $C_6H_5 \cdot CH : CH \cdot COOCH_3$, is a white crystalline compound, melting at 34° C., with a heavy amber fruity odour recalling strawberry. It has been identified as a constituent of the oils of watara, alpinia, galanga, and basil. Methyl cinnamate is useful as a fixative in Eastern compounds and amber Colognes, but is not valued so highly as the ethyl ester of cinnamic acid, which has a softer and sweeter odour. It is useful for

blending in soap compounds, especially those of carnation type. S.G., at 40° C., 1.066; B.P., 256° C.

7-Methyl Coumarin, $\text{CH}_3 \cdot \text{C}_6\text{H}_3$ , is a crys-

talline substance melting at 73° C. and having a powerful and persistent odour reminiscent of the wood of bitter-sweet, *Solanum dulcamara* (Judas vine). When blended with coumarin it is useful in fern, new-mown hay, and Oriental compounds, being particularly interesting in powders and creams. It is known also as *Toncarine*.

Methyl Cyclohexanol, $\text{CH}_3 \cdot \text{C}_6\text{H}_{10}\text{OH}$, is a liquid used as a middle boiling solvent in the lacquer industry. S.G., 0.903; B.P., 180° C.

Methyl Decine and Undecine Carbonates are liquids having similar properties to methyl heptene carbonate. They possess, however, a distinct waxy odour which makes them useful in reproducing perfumes such as iris, jonquille, and tuberose.

Methyl Duodecyl Aldehyde, $\text{CH}_3 \cdot (\text{CH}_2)_8 \cdot \text{CH}(\text{CH}_3) \cdot \text{CH}_2 \cdot \text{CHO}$, is a liquid having an extremely powerful odour of nondescript type. It is prepared by condensing methyl nonyl ketone (from rue oil) with bromoacetic ester in benzene solution in the presence of zinc. This aldehyde is used in minute traces only in bouquets of the violet, mimosa, and lilac types. B.P., 113° C. at 12 mm.

Methyl Ethyl Ketone, $\text{CH}_3 \cdot \text{CO} \cdot \text{C}_2\text{H}_5$, is a liquid of unpleasant odour used as a solvent. S.G., 0.812; B.P., 76° C.

Methyl Eugenol, $\text{CH}_2 : \text{CH} \cdot \text{CH}_2 \cdot \text{C}_6\text{H}_3 \cdot (\text{OCH}_3)_2$, is a yellowish viscous liquid having an odour resembling eugenol but less powerful. It occurs naturally in numerous essential oils and frequently is present in the same oils as eugenol. Amongst those of importance are: bay, citronella, pimento, Canadian snake root, laurel, enodia, betel, and "Brisbane sassafras." When methyl eugenol is boiled

with alcoholic potash it yields methyl iso-eugenol. It is used in small quantities for modifying carnation and lilac bouquets. S.G., 1.043; B.P., 248° C.

Methyl Everninate is a crystalline substance melting at 67° to 68° C. and is obtained by the alcoholysis of evernic acid. It is found in the methyl alcoholic extract of oak-moss but does not occur as such in the lichen. Methyl everninate has an odour recalling anethole and is known as **Sparassol**.

Methyl Formate, $\text{H} \cdot \text{COOCH}_3$, is a liquid of sweetish odour. S.G., 0.977; B.P., 33° C.

Methyl Furoate, $\text{C}_4\text{H}_3\text{O} \cdot \text{COOCH}_3$, is a yellowish mobile volatile liquid having an odour recalling a mixture of ethyl acetate, lactate, and benzoate. This ester of furoic acid should now be more easily available, since the furfural from which the acid is made is readily obtained from oat hulls by the action of steam and acid in a suitable enclosed vessel.

Methyl Heptenol, $\text{C}_8\text{H}_{16}\text{O}$, is a sweet-smelling alcohol found in cayenne and Mexican linaloe oils and is useful in rose bouquets and Oriental creations. S.G., 0.858; B.P., 180° C.

Methyl Heptenone, $\text{C}_8\text{H}_{14}\text{O}$, is an unsaturated ketone occurring in numerous essential oils, among which may be mentioned bois de rose, palmarosa, citronella, lemon-grass, and lemon. It is a colourless liquid having an odour resembling iso-butyl acetate. Methyl heptenone is not used in fine perfumery but is sometimes employed as a cheap soap perfume. S.G., 0.860; B.P., 174° C.

Methyl-heptene Carbonate, $\text{C}_8\text{H}_{14} \cdot \text{C} : \text{C} \cdot \text{CO} \cdot \text{OCH}_3$, is a colourless ethereal oil having a sharp, unpleasant, "heady" odour, which only develops its floral violet fragrance in extreme dilution. Commonly called *Vert de Violette, artificial*, it was discovered in 1903 by Moureu and Delange, and is probably one of the most difficult synthetics to manufacture. The starting-point in the

synthesis¹ is heptaldehyde obtained by the destructive distillation of castor oil. Methyl-heptene carbonate is one of the perfumer's indispensable raw materials, for not only is it a necessary adjunct in the preparation of violet perfumes, but it is successfully employed in numerous other floral odours for imparting a fresh leafy effect. This body requires to be sparingly used in violet compounds and 1 per cent is seldom exceeded. It is used by many in the "make-up" of ionone. For experimental purposes methyl-heptene carbonate is best used in a 10 per cent solution in alcohol. S.G., 0.930; B.P., 110° C. at 10 mm.

Some few years ago statements were made by certain American chemists and doctors that methyl-heptene carbonate was responsible for several cases of dermatitis, and its use was denounced for perfuming cosmetics on account of its suspected allergic properties. This question was investigated by the author in collaboration with Dr. W. J. O'Donovan, the eminent dermatologist. A violet perfume was prepared containing 6 per cent of M.H.C. and 0.2 per cent of this compound was used to perfume a cream of the skin food type containing lanoline. The percentage of M.H.C. was of course much too high, but it was made so for the purpose of these tests. Its dilution in the cream was therefore 1 in 8.300 or 0.012 per cent. Some 600 patch tests were made on both males and females—all with negative results.

Methyl Heptoate, $\text{CH}_3 \cdot (\text{CH}_2)_5 \cdot \text{COOCH}_3$, is a liquid having an intense floral fruity fragrance. It is useful in traces for modifying the odour of perfume bouquets.

Methyl-heptylene Carbinol, $\text{C}_9\text{H}_{18}\text{O}$, is a colourless oil having an odour of the rose type in which compositions it is occasionally used. S.G., 0.851; B.P., 186° C.

Methyl Heptyl Ketone, $\text{CH}_3 \cdot \text{CO} \cdot (\text{CH}_2)_6 \cdot \text{CH}_3$, is a colourless liquid having a pleasant odour of rue, in which oil it occurs naturally. It often constitutes the major portion of the Algerian oil, and has also been found in

¹ Complete accounts have appeared in the "P. and E.O.R." (1923), 291, and the "American Perfumer" (1923), 133.

clove and coco-nut oils. It is occasionally used in perfumery and then only as an alternative to methyl-*n*-nonyl ketone. S.G., 0.835 ; B.P., 196° C.

Methyl Hexyl Acetaldehyde, $C_6H_{13} \cdot CH(CH_3) \cdot CHO$, is an oil of powerful odour, isomeric with nonyl aldehyde. It has a fine flowery character and may be employed in creations such as cyclamen, lily, lilac, and jasmin.

***p*-Methyl Hydrocinnamic Aldehyde**, $CH_3 \cdot C_6H_4 \cdot CH_2 \cdot CH_2 \cdot CHO$, is an oil having a powerful odour of heliotrope type. It occurs naturally in cinnamon bark oil.

Methyl Indole—*see* Skatole.

Methyl Ionone, $C_{14}H_{22}O$, is a colourless or pale greenish-yellow liquid having an odour recalling irone and prepared by the condensation of citral and methyl ethyl ketone. There are four methyl ionones known to chemists but their preparation in the pure state involves a process of great difficulty. The *Alpha* has a mild sweet odour and in combination with hydroxy-citronellal would make an excellent base for cyclamen. The *Beta* is weak and lacks interest. The *Gamma* is probably the most familiar to perfumers because it constitutes the main part of commercial methyl ionones—the other isomers usually being present in varying proportions. The *Delta* has recently been prepared in the pure state by Dr. Hans Köster and olfactically it is an extremely interesting product. Not only has it a fine typically methyl ionone odour but this is shaded with nuances reminiscent of musk, patchouli, and oakmoss. Its use is immediately suggested in powder compounds, an example of which follows :—

300	Methyl ionone delta, pure.
250	Carnation compound.
50	Wallflower compound.
50	Jasmin compound.
270	Amber compound.
30	Jasmin absolute.
20	Orange blossom absolute.
30	Musk ketone.

1000

Methyl ionones are indispensable aromatics in numerous modern creations. S.G., 0.935; B.P., 158° C.

Methyl Iso-eugenol, $\text{CH}_3 \cdot \text{CH} : \text{CH} \cdot \text{C}_6\text{H}_3 \cdot (\text{OCH}_3)_2$, is a colourless or yellowish liquid obtained by boiling methyl eugenol with alcoholic potash. It occurs naturally in a few essential oils (*e.g.* Canadian snake root), and possesses an odour resembling iso-eugenol but not so powerful. It is useful for shading carnation and lilac perfumes. S.G., 1.058; B.P., 262° C.

Methyl Laurinate, $\text{CH}_3 \cdot (\text{CH}_2)_{10} \cdot \text{COOCH}_3$, is a solid substance of intense "heady" odour which assumes a floral nature on extreme dilution. It is used in traces in violet, jasmin, and mimosa bouquets. M.P., 43° C.; B.P., 141° C. at 15 mm.; S.G., 0.873.

Methyl Malonate, $\text{CH}_2(\text{COOCH}_3)_2$, is a colourless oil of powerful fruity fragrance. It is used in traces as a modifier. B.P., 181° C.

Methyl Methyl Anthranilate, $\text{C}_6\text{H}_4(\text{NH} \cdot \text{CH}_3)\text{CO} \cdot \text{OCH}_3$, is a crystalline substance melting at 15° C. and occurring in mandarin, petitgrain, and rue oils. It has an intense odour resembling ethyl anthranilate and is useful for replacing neroli in cheap artificial oils. It is also an excellent blender in soap compounds. The naturally extracted product is to be preferred to the synthetic. S.G. at 20° C., 1.1238.

Methyl Myristinate, $\text{CH}_3 \cdot (\text{CH}_2)_{12} \cdot \text{COOCH}_3$, is a solid at ordinary temperature having a remarkably powerful odour resembling orris, and is very useful in violet bouquets, especially those intended for perfuming powders.

Methyl- β -Naphthylacetaldehyde, $\text{C}_{10}\text{H}_7 \cdot \text{CH}(\text{CH}_3) \cdot \text{CHO}$, is a chemical body having a fine odour of orange blossom. It is known also as α -naphthyl-propionaldehyde.

Methyl Naphthyl Ketone is a white crystalline compound melting at 52° C., boiling at 295° C., and having the formula $\text{C}_{10}\text{H}_7 \cdot \text{CO} \cdot \text{CH}_3$. It is prepared synthetically by

condensing naphthalene with acetyl chloride in the presence of aluminium chloride and of monochlorobenzene. α -Acetonnaphthone has a pleasant odour recalling orange blossom and is sweeter, smoother than, and much superior to, the naphthol ethers. It can be successfully employed in the manufacture of all orange blossom type compounds or even eau-de-Cologne. The following formula will illustrate its use in the former case :—

100	Methyl naphthyl ketone.
100	Methyl anthranilate.
200	Linalol.
100	Bergamot oil, terpeneless.
100	Phenylethyl alcohol.
25	Ethyl phenylacetate.
20	Alcohol C_{10} .
5	Indole.
50	Hydroxy-citronellal.
300	Petitgrain oil, terpeneless.
1000	

Methyl Nonyl Acetic Aldehyde, $CH_3 \cdot (CH_2)_8 \cdot CH(CH_3) \cdot CHO$, is a powerfully odorous liquid having an odour recalling slightly that of orange, with a backing of amber. It is prepared by Darzen's glycidic reaction from methyl-*n*-nonyl ketone obtained from Algerian oil of Rue (*R. montana*). This aldehyde is used in traces, for giving distinction to new fancy bouquets, especially when a fresh, flowery note is desired. It is also employed in jasmin bouquets. Some modern perfumes have a very large percentage of this aldehyde in combination with others of the higher aliphatic series. S.G., 0.830; B.P., 120° C.

Methyl Nonylate, $CH_3 \cdot (CH_2)_7 \cdot COOCH_3$, is a liquid of intense fragrance used in traces as a modifier.

Methyl Nonyl Ethyl Alcohol, or secondary duodecyl alcohol, $CH_3 \cdot (CH_2)_8 \cdot CH(CH_3) \cdot CH_2OH$, differs considerably in odour from its isomer, having a soft balsamic note. It may be employed in lily creations.

Methyl Nonyl Ketone, $CH_3 \cdot CO \cdot (CH_2)_8 \cdot CH_3$, is

a colourless liquid having the characteristic odour of French oil of rue, from which substance it is separated. It occurs also in the Spanish oil and to a lesser extent in Algerian rue. This body is used for imparting a special note to such compounds as sweet-pea when the proportion seldom exceeds one-half per cent. It solidifies at 12° C. and boils at 230° C.

Methyl Octine Carbonate, $C_6H_{13} \cdot C : C \cdot CO \cdot OCH_3$, is a liquid which in dilute solutions possesses a fresh violet leaf smell. It is more stable and more pungent in the pure state than methyl-heptene carbonate. S.G. at 12° C., 0.924; B.P., 126° at 15 mm.

Methyl *para*-Tolyl Ketone—*see* Methyl Acetophenone.

Methyl Phenylacetaldehyde, known also as *p*-tolyl acetaldehyde, $CH_3 \cdot C_6H_4 \cdot CH_2 \cdot CHO$, is a semi-viscous liquid having an intense odour of syringa. It has a specific gravity of 1.010 and boiling-point of 203° C.

It should not be confounded with hydratropa-aldehyde, $C_6H_5 \cdot CH(CH_3) \cdot CHO$, which is known also as a phenyl propionaldehyde.

Methyl Phenylacetate, $C_6H_5 \cdot CH_2 \cdot COOCH_3$, is a liquid with a honey-like, somewhat musky odour, and is useful in rose-eglantine and honey compounds. It is blended with citronella oil as the basis of the latter soap compounds as follows :—

200	Methyl phenylacetate.
300	Citronella oil—Java.
100	Clove oil.
200	Geranium oil—Algerian.
120	Lemon-grass oil.
30	Peppermint oil.
50	Styrax.
<u>1000</u>	

This organic body has enjoyed some success also as a tobacco flavour. S.G., 1.071; B.P., 220° C.

Methyl Phenyl Carbinol—*see* Phenyl Methyl Carbinol.

Methyl Phenyl Glycidate of Ethyl, $C_6H_5 \cdot CH \cdot C(CH_3)$



.COO.C₂H₅, is a colourless liquid of fragrant odour having a distinct resemblance to strawberry. Traces of it are useful for obtaining a new note in fancy bouquets. It is commonly sold under the pseudonym Hexadecyl Aldehyde or Fræseol.

Methyl Phenylpropionate, $C_6H_5 \cdot CH_2 \cdot CH_2 \cdot COOCH_3$, is a colourless liquid having a sweet floral odour. It blends well with the crystalline fixatives, and on the addition of rose and jasmin absolutes makes an excellent perfume base. Used also in jasmin bouquets.

Methyl Phthalate, $C_6H_4(COOCH_3)_2$, is an odourless oil used like some of the ethyl esters, as an adulterant of essential oils. It is also a useful solvent.

Methyl Propionate, $C_2H_5 \cdot COOCH_3$, is a volatile liquid of fruity odour recalling rum. S.G., 0.900; B.P., 70° C.

2-Methyl Quinoline, $CH_3 \cdot C_9H_6N$, is a substance having an odour of lilac type.

7-Methyl Quinoline, $CH_3 \cdot C_9H_6N$, known also as lilacin, has an odour of honey-lilac type.

p-Methyl Quinoline, $CH_3 \cdot C_9H_6N$, is a chemical body having a powerful odour of honey-civet character. It imparts the characteristic note to honey compounds.

Methyl Salicylate, $C_6H_4 \cdot OH \cdot COOCH_3$, or artificial wintergreen oil, is the principal constituent of the oil from *Gaultheria procumbens* and *Betula lenta*, and is also found in numerous other volatile oils amongst which may be mentioned cassie, spice-wood, rue, tuberose, and viola tricolor (roots). It is artificially prepared on a large scale by the condensation of salicylic acid and methyl alcohol in the presence of sulphuric acid, and is of considerable value in medicine. S.G., 1.190; B.P., 223° C. Methyl salicylate

is also an important flavouring agent for dental preparations, and in perfumery can be usefully employed in synthetic cassie, tuberose, and chypre. An example of its use as a dental flavour is given :—

200	Methyl salicylate.
100	Clove oil.
100	Spearmint oil.
350	Peppermint oil.
50	Cinnamon bark oil.
200	Rhodinol.
<u>1000</u>	

Methyl Tolyl Ketone—*see* Methyl Acetophenone.

Metol is the sulphate of *p*-methyl aminophenol, $\text{CH}_3 \cdot \text{NH} \cdot \text{C}_6\text{H}_4 \cdot \text{OH}$, is used as a hair-dye, as described in Volume II. It is also a well-known photographic developer.

Miel—*see* Honey Compounds.

Mignonette (*Reseda odorata*) is a native of Egypt and the shores of the Mediterranean, and is cultivated in the south of France for its perfume, which is extracted from the fresh flowers by volatile solvents. This extract will yield traces of a powerfully scented essential oil, whose odour recalls violet leaves. The synthetic body, ethyl decine carbonate, has an odour which resembles reseda and is used in conjunction with orris, methyl ionone, basil, phenylacetaldehyde, dimethyl acetal, and santal oils for the production of mignonette compounds. For formulæ and further details reference should be made to the monograph on Reseda in Volume II.

Milfoil Oil is obtained by distillation from the fresh flowers of *Achillea millefolium*, L., known commonly as yarrow, a herb of the N.O. Compositæ. It is a dark blue liquid having an odour typical of the plant, and reminding of bornyl acetate. Cineole is the principal constituent together with valeric acid, eugenol, pinene, thujone, borneol, camphor, caryophyllene, and azulene—*see also* Iva Oil.

✓ **Mimosa** perfumes of good quality are all built up on the natural flower absolutes obtained by means of volatile solvents in the south of France from the flowers of *Acacia dealbata* and *A. floribunda*, trees belonging to the family Leguminosæ. Artificially, mimosa perfumes are compounded from methyl acetophenone, terpineol, hydroxycitronellal, etc. For a complete account reference should be made to the monograph in Volume II.

Mint Oils—see Peppermint.

Mirbane Oil is nitrobenzol, $C_6H_5 \cdot NO_2$, and has been found as an adulterant of essential oil of bitter almonds. It is used to perfume cheap household soaps—see also Nitrobenzene.

Mock Orange—see *Syringa*.

Monarda Oils are distilled from different species of the genus *Monarda*, plants belonging to the N.O. Labiatae. The most important of these to the perfumer is *M. didyma*, L., a native of the United States. Oils distilled by Schimmel & Co.¹ were pale yellow in colour and possessed a sweet balsamic odour reminiscent of lavender and ambergris. *M. punctata*, L., is another North American perennial having a phenolic-minty odour and is known as horsemint.

Mono-Chlor Thymol is a white crystalline solid, melting at 59° to 61° C. and is universally acknowledged to be one of the most powerful of all bactericides. It has a characteristic odour and an aromatic very pungent taste. It may become yellowish on keeping. Almost insoluble in water, this compound dissolves freely in alcohol, hydrocarbons, chloroform, etc., and in dilute aqueous caustic solutions.

Morpholine, C_4H_9NO , is a colourless liquid having a slightly ammoniacal odour. S.G., 1.001 at 20° C., and B.P., 128° C. It is miscible with water in all proportions, and reacts as a secondary amine in the same way as its

¹ "Report" (October, 1904), 97; (November, 1909), 86.

related compound, diethanolamine, of which it is the anhydride. It forms an effective emulsifying agent in combination with fatty acids, and is of similar type to triethanolamine, but more strongly basic.

Mousse de Chêne—*see* Oakmoss.

Muguet—*see* the monograph on Lily in Volume II.

Muguetine Principe—*see* Hydroxy-citronellal.

Muscade—*see* Nutmeg.

Muscatel Sage Oil—*see* Clary Sage.

Mushrooms are well known to have odours of different types, some of which are very unpleasant. Of the former, there are a few which might be of interest :—

Jasmin—*Hygrophora hyacinthinus*.

Cucumber—*Tricholoma aurantium*.

Lavender—*Clitocybe geotrope*.

Bergamot—*Lactary glyciosmos*.

Melilot—*Lactary camphoratus*.

Cherry laurel—*Hygrophora agathosmus*.

Aniseed—*Psatella arvensis*.

Musk is the dried secretion from the preputial follicles of the male musk deer, *Moschus moschiferus*, L., N.O. Ungulata, which inhabits the mountainous districts of the Atlas and Himalayan ranges. Other important commercial species are known, of which the following are worthy of note :—

M. Chrysogater from the Szechwan-Thibetan border and sometimes from the higher parts of Yunnan.

M. Sifanicus from the North-West Szechwan and parts of Kansu.

M. Sibiricus from the mountainous regions of Shansi. These animals have a dark brown fur and a creamy patch at the throat.

Musk occurs in commerce in four well-defined varieties as follows :—

1. Tonquin.
2. Cabardine.
3. Yunnan.
4. Assam and Nepal.

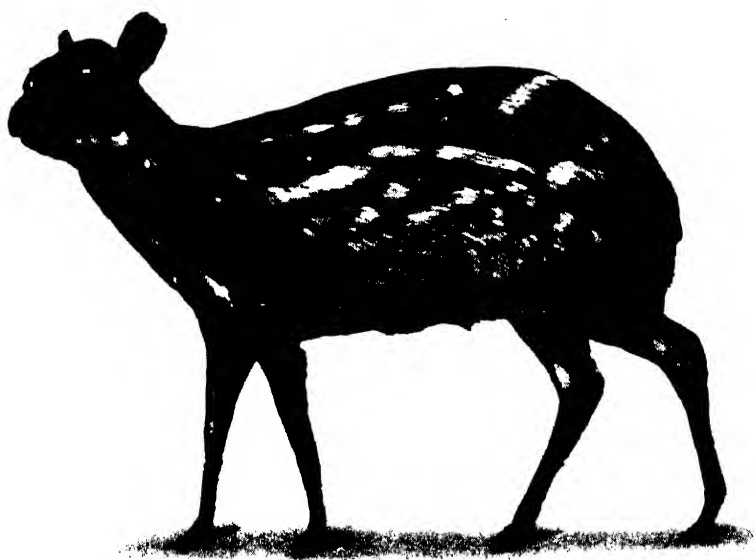
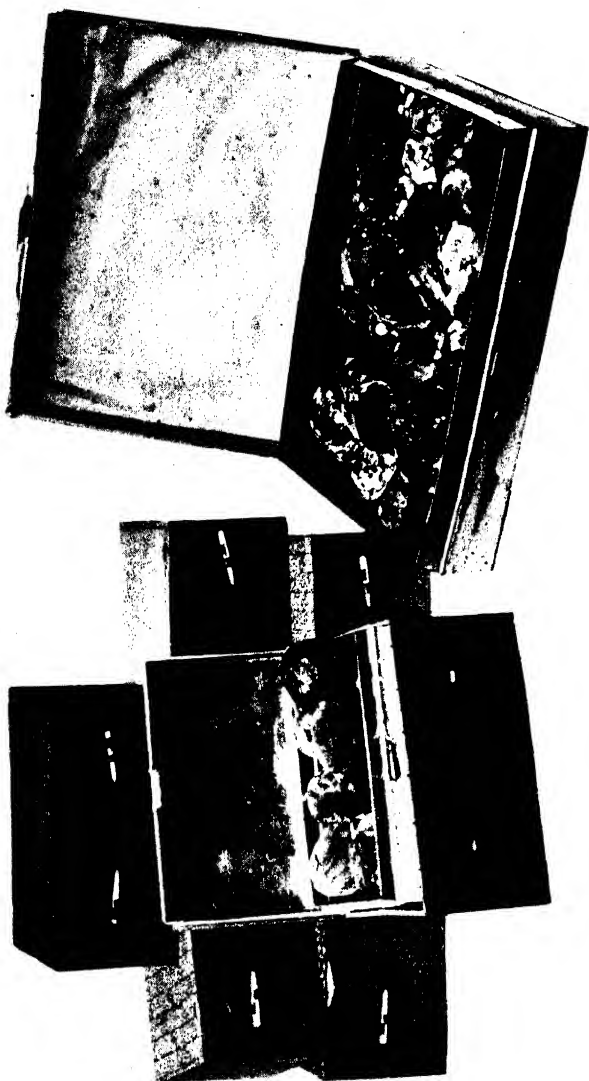


FIG. 30.—The Male Musk Deer. *[Les Parfums de France.*
[To face page 282.



[*R. C. Treatt & Co., Ltd*
showing on the left six "caddies" and on the right a newer
form of packing.

[*To face page 283.*

Of these the foremost place is undoubtedly held by **Tonquin Musk**, coming from Thibet, Szechwan (now known as Sikang), French Indo-China, and the mountains of the adjoining provinces. This kind accounts for about 85 per cent of the total imports. It arrives on the London market in boxes as illustrated here. They are quite elegantly finished, the exterior being covered with silky material of peculiar design and the interior lined with metal—usually tin. These containers are known as “caddies,” and each contains one “cattie” which generally represents about 21 oz. weight of musk.¹ Each **Musk Pod** is usually wrapped in tinfoil,² and consists of a nearly round sac, about one and a half inches in diameter, which is almost smooth on one side and covered on the other with dark appressed hairs, concentrically arranged around a nearly central orifice. Thibetan musk is known locally by different names suggestive of their character as for instance, “lard” musk, “vegetable-oil” musk, “snakes-head” musk.

Blue Skin musk is generally the most esteemed form in which this perfume material may be purchased, but it is said to be ordinary Tonquin musk which has undergone transformation at the hands of expert natives in Shanghai. The inner side of the skin covering is deftly removed, and this leaves a bright “steely” blue membrane. It is sometimes known as “Blue Pile.”

Grain Musk consists of the dried secretion, together with hairs, etc., which is carefully removed from the pod. The grains are irregular and unctuous, of a reddish-brown to black colour, and exhale a characteristic, penetrating, and persistent odour. They should

¹ Consignments are usually of five cattles; four of Pile I., and one of Pile III. The latter contains some Pile I., so that there is generally about 85 per cent. of this better grade musk.

² Wax paper or parchment is always used in the flat tins.

not contain any membrane as this is particularly prone to putrefaction.

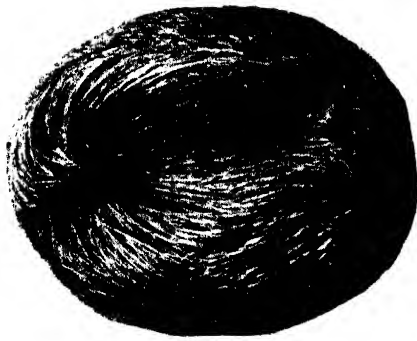
Cabardine Musk occurs in two varieties, Chinese and Russian, but both are inferior to the above. The term is of commercial significance, "Kabarga" being the local appellation for musk deer in the Atlas mountains of outer Mongolia and the borders of Southern Siberia.

Yunnan Musk occurs in what are often termed "pig-faced pods," and are easily differentiated from the Tonquin by their shape.

Assam and Nepaul Musk occurs in very small pods, but these varieties are not much esteemed.

Collection.—Although the musk deer inhabits a large area of Central Asia, the animals yielding the finest musk are found in Thibet, and especially in the plains of Kokonor. They are captured by one of three methods, and unfortunately the hunters do not discriminate between males and females so that the extinction of the species is by no means a remote possibility. According to J. H. Bothelo of Shanghai¹ shooting is not the easiest method, because the huntsman must climb among the mountain fastnesses like a chamois hunter. In the summer the animal is found only rarely below the 8000 foot level and generally keeps himself well hidden in the dense thickets of birch, rhododendron, and juniper. Besides, it is a hardy, solitary animal of a decidedly retiring disposition and is rarely found in pairs and never in herds. Moreover, the hunter must maintain a complete silence when near his quarry as the deer have an extremely acute sense of hearing. Curiously enough this protective faculty is sometimes made so to serve as a means of luring the shy fugitive to his destruction. A hunter selecting an appropriate location, will begin some lively air on his flute to the intense astonishment and curiosity of all the musk

¹ "Ungerer's Bulletin," 4 (1923), 2.



Tonquin.

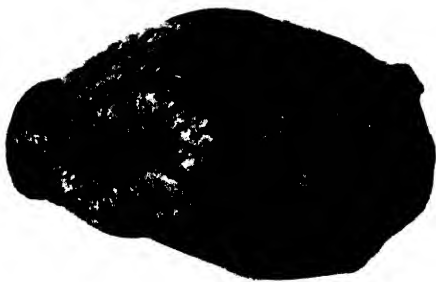


FIG. 32.—Musk Pods—actual size.
Cabardine



[*R. C. Treat & Co., Ltd.*
Yunan.
[To face page 284.



FIG. 33.- A Pod of Tonquin Musk being Grained.
[*R. C. Treat & Co., Ltd.*
[To face page 285.

deer within a wide range. Unaccustomed to such melodious harmony amid the barren crags and rocky fastnesses the deer allow their enthusiastic appreciation to lull their instinctive caution and approach sufficiently near the place of ambuscade to permit of their easy slaughter. Less romantic but more effective is the second method consisting of snaring the deer by placing nets and gins in its customary runs. Even this is difficult owing to the excessive wariness of the quarry. Most of the deer are captured, continues Bothelo, by the third method consisting of the construction of traps into which the deer are driven. A deep defile of suitable shape is chosen, and the sides and ends closed with a sort of palisade of thick prickly bushes too strong for the deer to penetrate. The hunters then spread out fanwise at a distance, and advance concentrically towards the open mouth of the defile, and uttering loud cries with the idea of driving all the musk deer within their range into the prepared trap. If the manœuvre proves successful other hunters who have lain in wait for the completion of the drive close the open end of the trap with nets made of a species of wild hemp, green and unbroken, so as to more easily escape the eyes of the destined victims.

Young animals do not yield much secretion and are not worth killing. As a rule the most prized are bucks of about 10 years when one-half to two ounces of musk may be anticipated. After the animal has been killed the gland is completely removed and dried by one of three methods. Either it is sun-dried or placed on a heated stove or immersed in hot oil. While fresh the gland is almost completely lacking the characteristic odour which develops on drying. They leave the musk pods in a rough and dried or semi-dried condition with an outer covering of hair and hide, the prevailing odour being that of the uncured hide. A fair proportion of the encumbering hide and hair is now cut away and the pods allowed to soak for some time in water to bring them to their natural soft condition. They now exhale a pleasant, agreeable perfume.

The trade in Chinese musk centres principally in Tatsienlu in the province of Szechwan, and to some extent also in Sungpan and Chengtu. For export it is then shipped via Chungking or Shanghai, but a large quantity is consumed in China, since musk is much esteemed as a medicine. According to the "Chinese Economic Bulletin"¹ the annual output of musk from Sikang and the surrounding districts is about 20,000 pods.

Adulteration.—Musk is liable to adulteration with earth, dried blood, etc., but this will be indicated on incineration and by microscopical examination. The limit of ash is 8 per cent, and moisture should not exceed 15 per cent, but it must be borne in mind that it will not pay the average buyer to completely examine each purchase. The best advice is "Buy from a firm of repute and accept their assurance of purity." The Chinese use a special instrument, called a *Sonde* or *Sounding Linker*, for abstracting the grain musk from the interior of the pod through the nearly central orifice. This can be examined and replaced without disturbing the appearance of the pod in any way. It is illustrated opposite. The point at which adulteration is most practised was a subject of investigation by Roure-Bertrand Fils.² According to their information, fraudulent manipulations take place principally between Thibet and Tatsienlu where it is delivered to the merchant, and possibly at Tatsienlu itself. Between this town and Shanghai any manipulation is impossible. The original cases, in order to protect them from the action of air and water, are sewn up in a fresh bullock's skin which in drying becomes as hard as stone. Moreover, the package travels under the seals of the Customs. This package is absolutely inviolable, and it is even not easy to open at its destination. This operation is carried out by the Customs after which the goods are handed over to the merchants.

¹ Vol. XXII., No. 14, quoted by "P. and E.O.R." (November, 1933), 378.

² "Bulletin" (October, 1913), 75.



FIG. 34. Chinese Sounding Linker and Musk Pod.

[To face page 286.]



FIG. 35.--Abstracting the Musk Grain for examination.

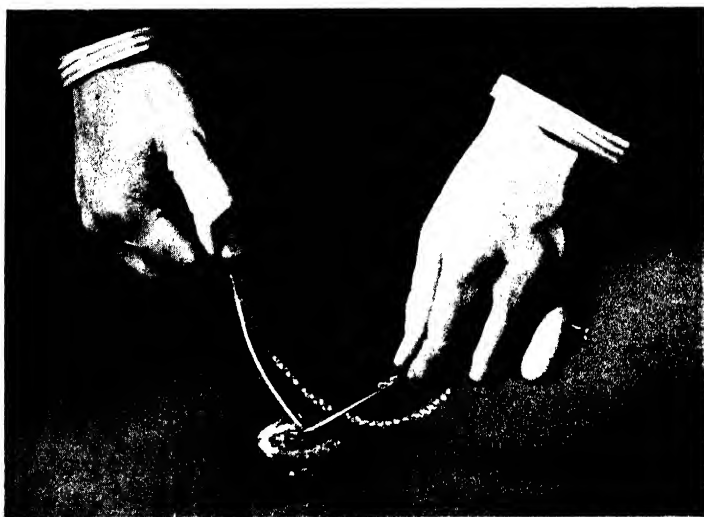


FIG. 36.—Returning the Grain to the Pod.

[To face page 287.]

Odour.—The odoriferous principle which occurs to the extent of about 2 per cent has been isolated by Schimmel & Co.¹ It is a ketone in the form of a dark brown volatile oil, possessing an intense odour of musk and has been named **Muskone**. The perfume exhaled by this body will rapidly fatigue the olfactory nerves, but a peculiar feature of the commercial article is that it appears to completely lose its odour at times, especially if kept in a hermetically sealed vessel for a long period. This will, however, soon re-develop in treating the pod or grains with small quantities of ammonia or other alkali. A substance having an intense odour approaching that of muskone has been placed on the market by a Swiss firm. It is described as "Exaltone" and is sold in 10 per cent alcoholic solution. (*Compare Muskone and Exaltolide.*)

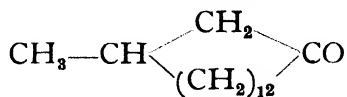
Solubility.—Water will dissolve about 50 per cent of unadulterated musk, while from 10 to 20 per cent is soluble in strong alcohol.

Uses.—In spite of the many artificial musks, the natural raw material is undoubtedly the most indispensable article used in perfumery. It is esteemed just as much for the subtleness of its odour as for its wonderful diffusive power, and those perfumes that do not contain some of it are usually lacking in "life." The art in its use lies in being able to employ so little of it in fortifying the basic odour that the bouquet *appears* to remain unchanged during evaporation. The *form* in which musk may be best employed is given in detail in the chapter on fixation in Volume II. (*which see*).

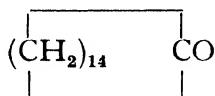
Manipulation.—When handling this raw material considerable care is desirable since the removal of its odour from the hands and laboratory ware is a matter of some difficulty. *Camphor* and *benzaldehyde* are the two most useful articles for this purpose, and an alcoholic solution of either, applied before a soapy lather, will be found effective.

¹ "Report" (April, 1906), 94.

Muskone is the highly odorous ketone present in animal musk (*which see*), and having the constitution



A similar product has recently been prepared synthetically by a Swiss firm and is marketed under the name "Exaltone." Chemically it is known as Cyclopentadecanon or Ketone C_{15} , and has the constitution



A complete account of the synthesis by M. L. Ruzicka is issued in a booklet which can be had from the firm of M. Naef & Co., Geneva.

Musk Plants are numerous; either their flowers, roots, or seeds exhaling an odour reminiscent of musk. Among them may be mentioned :—

- White musk mallow (whole plant).
- Spikenard (roots).
- Sumbul (roots).
- Ambrette (seeds).
- Musk thistle (flowers).
- Mimulus (flowers).

The last one, *Mimulus moschatus*, Douglas, a plant belonging to the N.O. Scrophulariaceæ, is a native of North America, and years ago was much grown in this country on account of its delightful musky odour. It has recently been noticed, however, that seeds sold by horticulturists as "musk plant" did not in fact produce odorous flowers. This matter has been the subject of investigation by the late E. M. Holmes,¹ who came to the conclusion that the loss of scent was not due to the absence of glands, but possibly to a change in the nature of the secretions formed in them.

¹ "Gardener's Chronicle" (1924), 78; "Chemist and Druggist" (1924), 258.

Musks, Artificial, are a series of highly nitrated tertiary butyl toluenes or xylenes, or other closely related nitro-compounds, which have no relation chemically to natural musk, but approximate to it slightly in odour value. The first variety to be commercially produced was "musk Baur," patented in 1888, and now generally described as **Musk Xylene**. The present-day product is tri-nitro-tertiary butyl-xylene, $C_4H_9 \cdot C_6(NO_2)_3 \cdot (CH_3)_2$, and melts at 112° to 113° C. when pure. Musk xylene exists in a "labile" crystalline form, which, although quite pure, has a lower melting-point, *viz.* 105° to 106° C. If this is melted and then allowed to solidify, it will be transformed to the "stable" condition and show the correct melting-point. It was at one time much adulterated with acetanilide, but owing to its present cheapness, sophistication is seldom practised. Its odour is musky, but modified by a sort of fatty taint when compared with the other artificial musks. It is very useful in shampoo powder perfumes, and may be dissolved in benzyl benzoate or ethyl phthalate. Musk xylol has probably its widest application in soap perfumery, since it gives to a tablet of soap an indefinable sweetness which is unobtainable with other substances. It will blend well with almost all the raw materials of soap perfumery. An example of a musk compound for soaps is appended :—

200	Geranium oil—Spanish.
50	Palmarosa oil.
150	Cedarwood oil—English.
100	Clove oil.
30	Cassia oil.
50	Lemon oil.
40	Benzyl acetate.
50	Sandalwood oil.
10	Vetivert oil—Bourbon.
100	Castor extract, 10 per cent absolute.
10	Civet synthetic.
150	Musk xylene.
60	Musk ambrette.

1000

Musk Ketone is the most expensive product and is the acetyl derivative of di-nitro-butyl-xylene, $\text{CH}_3 \cdot \text{CO} \cdot \text{C}_6(\text{C}_4\text{H}_9)(\text{CH}_3)_2(\text{NO}_2)_2$. It melts at 135°C ., and possesses an odour more nearly approaching that of the natural article. It is known also as **Musk C**. and is most appreciated in fine perfumery.

Musk Ambrette is probably the most important artificial product, and its odour, although persistent, recalls that of ambrette seed oil rather than that of natural musk. It is the methoxy derivative of musk Baur 1, or may be described as tri-nitro-butyl-meta-cresol-methyl-ether, $\text{C}_4\text{H}_9 \cdot \text{C}_6 \cdot (\text{NO}_2)_3 \cdot \text{CH}_3 \cdot \text{OCH}_3$. It melts about 85°C ., and is soluble in three times its own weight of benzyl benzoate.

The three products briefly outlined above are very largely employed in perfumery as they are so much cheaper than natural musk. The *Ketone* has by far the widest application amongst continental perfumers owing to its softness of odour compared with the others. The *Ambrette* is most frequently used in England where its typical strong odour is much appreciated. The application of this material as a base of synthetic musk perfume is shown by the following formula, which may be advantageously employed as a soft and sweet perfume for face powders :—

450	Musk ambrette.
150	Rhodinol.
5	Cassia oil.
25	Ionone.
50	Santalwood oil.
10	Clary sage oil.
10	Vetivert oil—English.
300	Amyl benzoate.
<u>1000</u>	

Directions.—Powder the musk crystals finely and rub down with the liquids—incorporate into 1000 grams of talc, and store in a well-stoppered bottle—use 1 to 4 oz. to every cwt. of toilet powder.

Other varieties of artificial musk are known, and these are described with formulæ by Noeltig in the "P. and E.O.R.," March, 1922, to which reference should be made for further details.

Musk Solubility Table in grams per *litre* of alcohol 95 per cent. and grams per *kilo* of other solvents :—

Solvent. Litre or Kilo.	Xylene. Grams.	Ketone. Grams.	Ambrette. Grams.
Alcohol, 95 per cent	7	15	20
Benzyl alcohol .	89	134	290
Ethyl phthalate .	153	155	161
Benzyl benzoate .	280	205	450

Musk Rat Oil is one of the more recent products offered by the Hudson Bay Company. It is a light yellow oil having a musky odour. The musk rat, which is a rodent related to the beaver, *Castor fibre*, L., is found largely in North America, and millions of rats are there trapped annually in order to obtain their pelts, which constitutes the well-known musquash fur.

The rats have also been imported into Europe, and a good deal has been heard in this country lately of danger caused to embankments, etc., by their burrowings. An interesting description of these rats was recently given by C. A. Oldfield.¹

As its name implies, the musk rat has a distinct musk-like odour, derived from glands contained in the abdomen. From time to time the use of these glands in perfumery has been suggested, but hitherto no serious attempt has been made to collect them. Recently, however, the Hudson Bay Company have collected a considerable quantity, and a sample of these was examined by W. H. Simmons and C. A. Hills.²

¹ "Soap Trade and Perfumery Review" (April, 1932), 277.

² "Analyst" (March, 1933).

The glands had been slightly smoked to prevent putrefaction, and had an average weight of about 3 grams per pair of glands. They are very oily on the surface, any paper in which they are wrapped quickly becoming very greasy. On extraction with petroleum spirit, they yield 50 to 54 per cent of an oil, one specimen of which had the following values :—

Acid value	80.6
Saponification value	145.9
Iodine value	136.9
Unsaponifiable matter	22.8 per cent
Insoluble fatty acids	70.0 „ „

The fatty acids give the following results :—

Mean molecular equivalent	307
"Titra"	28.3° C.
Refractive index (n_D^{40})	1.4558
Iodine value	87.3
Solid acids ¹	34 per cent
M.pt. of solid acids	43.0° C.
Iodine value of solid acids	57.5
Mean molecular equivalent of solid acids	338
Iodine value of liquid acids	112

The unsaponifiable matter has, for perfumery purposes, been separated into two fractions—44.5 per cent soluble, and 55.5 per cent insoluble, in 90 per cent alcohol—and the iodine values of these were : alcohol-soluble, 122 ; alcohol-insoluble, 333.

The nitrogen-content of the extracted glands was 12.2 per cent.

The most interesting of the above figures are (1) the high iodine value and mean molecular equivalent of the solid acids, indicating the presence of unsaturated acids of high molecular weight ; and (2) the very high iodine value of the unsaponifiable matter insoluble in 90 per cent alcohol.

Musk Seed—*see* Ambrette.

¹ Determined by the modified lead, salt and alcohol method, "Analyst" (1931), 56, 376.

Myrcia Acris—*see* Bay.

Myristic Acid, $C_{13}H_{27}COOH$, has recently received some notice as a constituent of soaps and shaving preparations. Its soaps are as soluble and free lathering as those from coco-nut oil, while it is much milder in its action upon the skin. The foam produced has been described as fabulous, while the lather has a creamy texture of unique character.

Myristic Aldehyde, $C_{13}H_{27} \cdot CHO$, is an oily substance having a mild odour of orris type. It bears no relationship to the pseudo-aldehyde C_{14} .

Myristica—*see* Nutmeg.

Myrrh is a gum-resin exuded from the stem of *Commiphora myrrha*, Holmes, and probably other species of the N.O. Burseraceæ. It is one of the earliest¹ gum-resins mentioned in history, and in nearly all cases is referred to in conjunction with spices and must therefore be supposed to have been of considerable value as a perfume. It seems probable, however, that this early reference is not to true myrrh but to labdanum.² The first reference to myrrh in history³ upon which authorities can agree most probably refers to *perfumed* myrrh or bisabol (*which see*). The true myrrh or herrabol myrrh is obtained from Arabia and Abyssinia, while bdellium or bisabol myrrh is usually collected in Somaliland and resembles Indian bdellium. The latter (bisabol myrrh) occasionally occurs as an admixture of true myrrh. Two varieties of true myrrh are recognised by the natives of Arabia and Abyssinia, *viz.* guban myrrh and ogo myrrh. The trees producing the former are about 5 feet high and grow principally on low-lying land, whereas those yielding the latter attain a height of about 15 feet and are distributed on the mountain ranges. The gum-resin is secreted between the cortical

¹ Gen. xxxvii. 25 (1729 B.C.).

² Consult the author's paper in the "American Perfumer" (April, 1924), 75.

³ Exod. xxx. 23.

layers of the tree from which it spontaneously exudes and falls to the ground. It is collected in goat-skin bags and is subsequently brought down to the coast. This resinous substance has an agreeable aromatic odour and on distillation yields about 5 per cent of essential oil. A tincture (1 in 5 in 90 per cent alcohol) is useful in liquid dentifrices, and a strong extract (1 in 2) is valuable as a fixative in Oriental perfumes. It is also recommended for broom and honey-suckle compounds. The most convenient form in which this product may be used is the already purified resinoid prepared by all the Grasse houses by the volatile solvent process.

Myrtle Oil is distilled from the leaves of *Myrtus communis*, L., N.O. Myrtaceæ, a bushy shrub (under favourable conditions a tree of 20 ft. or more in height) having fragrant flowers as well as leaves and found on the shores of the Mediterranean. The oil is yellowish-green in colour, has a characteristic odour, and is present in the leaf to the extent of about 0.3 per cent. Myrtle oil contains pinene, borneol, iso-borneol, cineole, myrtenol, geraniol, and nerol. It is a useful constituent of Eastern bouquets of certain soap compounds.

Naphthol Ethers—see β -Naphthol.

α -Naphthyl-Propionaldehyde—see Methyl- β -Naphthyl-acetaldehyde.

Narceol is a name given to a proprietary narcissus base, and is probably para-cresyl-acetate.

Narcissus is largely cultivated in the Mediterranean littoral, the most popular variety being *N. Jonquilla*, N.O. Amaryllidaceæ. The perfume is extracted by enfleurage and volatile solvents. Artificial narcissus is a mixture of phenylethyl alcohol, terpineol, methyl ionone, anisic aldehyde, benzyl acetate, and linalol, with up to 10 per cent of phenylacetic aldehyde or para-cresol. Very dilute solutions of para-cresyl-acetate, iso-butyrate or phenyl-acetate have an odour resembling narcissus, and the

addition of about 1 per cent of either of these bodies to any artificial narcissus oil improves it. For further details consult the monograph in Volume II.

Nard—see Spikenard Oil.

Nauli "Gum" is the soft, yellow, oleo-resinous secretion from *Canarium commune*, L., the "Java almond tree," belonging to the N.O. Burseraceæ and found growing in the Solomon Islands. On steam distillation it yields about 10 per cent of volatile oil containing 34 per cent of anethole.

Nelumbium Speciosum, also known as the sacred bean in India, is a beautiful aquatic of the water lily family, and stated by some writers to be the Egyptian lotus of the ancients. The flowers, which are rose-pink or white in colour, resemble gigantic tea roses and are delightfully fragrant. They are not often found in the Nile to-day, but at one time they appear to have been common there and were held sacred by the worshippers of Isis, as is evident by the sculptures and representations of the flower found in the ruins of the ancient temples. Its worship is by no means confined to the ancient Egyptians, for in India, Thibet, China, and Japan the plant was deemed sacred, and indeed is still employed in religious invocations and ceremonies. The leaf stalks abound in spiral fibres, which are carefully extracted and made into wicks to burn before the idols, and its leaves are used as plates in which offerings are placed—see also Lotos.

Neral, or neraldehyde, is isomeric with Citral (*which see*).

Nerol, $C_{10}H_{17}OH$, is stereoisomeric with geraniol, and, like this alcohol, is found in the free state or in the form of esters in several essential oils, among those of importance being rose, neroli, champaca, wallflower, ylang-ylang, and *Helichrysum angustifolium*, N.O. Compositæ. It was first synthesised by Heine in 1902. Two kinds of nerol are obtainable, one by separation from petitgrain oil, or from oil of helichrysum, and the other by synthesis from geraniol.

Nerol from the latter is manufactured by Verley¹ in the following manner: Pure geraniol is saturated with one molecule of hydriodic acid in the presence of a neutral solvent. The iodised oil obtained is treated with alcoholic soda, giving nerol. This is a colourless liquid with a sweet rose-neroli odour. There are two or three grades of nerol on the market, and while the best are exquisite products, others would appear to contain some geraniol. S.G., 0.880; B.P., 226° C. Nerol is useful in all orange blossom and many rose compounds. It is a beautiful base for magnolia as follows:—

300	Nerol.
200	Hydroxy-citronellal.
100	Lemon oil.
100	Ylang-ylang oil—Manila
100	Cinnamic alcohol.
10	Iso-eugenol.
10	Vanilla absolute.
130	Jasmin compound.
50	Musk ketone.
1000	

Nerolidol, $C_{15}H_{26}O$, is a sesquiterpene alcohol occurring in orange flower oil and Peru balsam oil. It may be obtained synthetically,² and when treated with acetic anhydride will yield farnesol. It has a peculiar lily-like odour and may be used in muguet, lilac, jasmin, and orange blossom compounds. S.G., 0.880; B.P., 129° C. at 6 mm.

Nerolin—see β -naphthol methyl ether.

Neroli Oil is obtained by distillation from the fresh blossoms of the sweet and bitter orange. The former, being known as oil of neroli *Portugal*, is not so valuable as the latter, which is described as oil of neroli *Bigarade*. Neroli oil is distilled largely at Vallauris in the South of France, and this product commands the highest price. The growers have formed an association which controls its own factories

¹ "La Parfumerie Moderne" (1920), 143.

² See the patent specification of Naef & Co. in the "American Perfumer" (1924), 506.

and fixes the prices. Other oils are distilled in Algeria, Sicily, Spain, and Syria, but with the exception of the former they do not possess such a delicate bouquet and are not by any means as expensive. Neroli oil is a pale yellow liquid which darkens on exposure to light; it possesses a sweet odour of fresh orange blossom, and is indispensable in the preparation of eau-de-Cologne. Among the known constituents of the genuine oil are limonene, linalol, esters of geraniol, linalol, and nerol, phenylethyl alcohol, methyl anthranilate, and indole. Synthetic neroli is now a common article of trade, and in spite of its cheapness possesses a remarkable likeness to the genuine oil. The following formula will indicate the lines upon which this product may be built up:—

550	Petitgrain oil, terpeneless, Para.
150	Nerol.
70	Linalol.
50	Linalyl acetate.
35	Methyl anthranilate.
100	Phenylethyl alcohol.
4	Decyl aldehyde, 10 per cent.
1	Indole.
40	Methyl naphthyl ketone.
<u>1000</u>	

Terpeneless neroli oil is about three times concentrated and commands a very high price. For further details regarding orange flowers and their commercial products, reference should be made to the monograph on that subject in Volume II.

Neryl Acetate, $C_{10}H_{17}OOC \cdot CH_3$, is a colourless to pale yellow liquid of sweet floral odour and occurs naturally in neroli oil. It is of the geranyl acetate type and is a useful substance in the production of artificial neroli and jasmin oils. Neryl acetate is also a useful sweetener in fine perfume bouquets. S.G., 0.907; B.P., 105° C. at 5 mm.

Neryl Butyrate, $C_{10}H_{17}OOC \cdot C_3H_7$, is a liquid having a fruity orange-rose odour. It is a useful modifier in perfumes. S.G., 0.897; B.P., 128° C. at 5 mm.

Neryl Formate, $C_{10}H_{17}OOC.H$, is a substance having a sweet penetrating odour of orange-rose type. It is used very much as the acetic acid ester. S.G., 0.916; B.P., 105° C. at 12 mm.

Neryl Iso-butyrate, $C_{10}H_{17}OOC.CH.(CH_3)_2$, is an oil of sweet rosaceous fragrance. It is much employed in rose, neroli, and fancy bouquets. S.G., 0.8936; B.P., 130° C. at 3 mm.

Neryl Phenylacetate, $C_{10}H_{17}OOC.CH_2.C_6H_5$, is a liquid of honey-rose odour. It is a useful modifier.

Neryl Propionate, $C_{10}H_{17}OOC.C_2H_5$ is an interesting addition to the list of synthetics, and is recommended strongly for violet compositions where new and original shades are desired. It is also a valuable asset in reproducing the odour of honeysuckle, lily, neroli, and jasmin. S.G., 0.904; B.P., 116° C. at 5 mm.

Neryl Valerianate, $C_{10}H_{17}OOC.C_4H_9$, is one of the newer esters of nerol. It has an odour which suggests its usefulness in tobacco flavours of the Gold Flake type. S.G., 0.8898; B.P., 128° C. at 6 mm.

New-mown Hay—see the monograph in Volume II.

Ngai Camphor is the product of distillation of *Blumea balsamifera*, D.C., a shrubby-plant of the N.O. Compositæ, and a native of India, Tonquin, and the Malay Archipelago. It is stated to be used by the natives in the preparation of Indian ink and in the performance of religious ceremonies. It consists principally of *l*-borneol and *l*-camphor.

Niaouli Oil is distilled from the leaves of *Melaleuca viridiflora*, Brongn et Grio, a tree of the N.O. Myrtaceæ, widely distributed throughout New Caledonia and occurring also in Annam. In general properties it resembles cajuput oil, is lemon-yellow in colour, and is sometimes known as "Gomenol." Cineole is the principal constituent.

Nigapin, Nipasol, etc.—see *p*-Hydroxybenzoic Acid Esters.

Nigella Oil is distilled from the seeds of *Nigella damascena*, L., often inappropriately described as "black Caraway" (*N. sativa*, L.). Schimmel & Co.¹ obtained a yield of 0.37 per cent of a yellow oil having a pronounced blue fluorescence (due to contained damascine). The odour of the oil recalls that of ambrette seeds, while the crushed seeds give off a clearly perceptible smell of strawberries.

Nikkel Oil is obtained by distillation from the leaves and young twigs of *Cinnamomum laureirii*, Nees, a tree of the N.O. Lauraceæ, indigenous to Japan. It is a bright yellow liquid and possesses an odour suggestive of lemon and cinnamon. The principal constituents are citral, linalol, and cineol. The stems and roots of the tree yield an essential oil rich in cinnamic aldehyde.

Niobe Oil—*see* Methyl Benzoate.

Nitrobenzene, $C_6H_5 \cdot NO_2$, is a colourless or brownish-yellow inflammable poisonous liquid, having a crude but strong odour resembling that of benzaldehyde, and is known in commerce as **Oil of Mirbane**. It is not used in fine perfumery, but is employed in the soap industry, particularly for cheap toilet and household soaps. S.G., 1.20; B.P., 208° C.

Nitro-Cellulose occurs as a fine, white fibrous substance resembling cotton in appearance. It may be obtained in varying degrees of *viscosity*, damped down with industrial spirit or iso-propyl alcohol, the percentage usually being stated by the maker. Nitro-cellulose is used in the preparation of fine manicure enamels of which an account appears in Volume II. It should be stored in air-tight containers.

Nitro-Cotton—*see* Nitro-Cellulose.

Nonanal—*see* Nonyl Aldehyde.

Nonyl Acetate, $CH_3 \cdot (CH_2)_7 \cdot CH_2OOC \cdot CH_3$, is a liquid of pungent odour reminding of mushrooms and

¹ "Report" (1926), 80.

perhaps gardenia. It is used in this type of compound. S.G., 0.878.

Nonyl Alcohol, $\text{CH}_3 \cdot (\text{CH}_2)_7 \cdot \text{CH}_2\text{OH}$, is a colourless liquid with a peculiar, characteristic sharp odour, recalling rose, with a suggestion of neroli. It has been identified as ester in sweet orange oil. Alcohol C_9 is useful for giving special notes to synthetic rose ottos—*e.g.* rose d'orient :—


300	Geraniol.
300	Citronellol.
130	Benzyl acetate.
150	Guaicwood oil.
20	Nonyl alcohol.
100	Rose virgin.
1000	

Known also as pelargonic alcohol, nonyl alcohol is used in the preparation of artificial jasmin and neroli oils. S.G., 0.838 ; B.P., 214° C.

Nonyl Aldehyde, $\text{CH}_3 \cdot (\text{CH}_2)_7 \cdot \text{CHO}$, has been found in the oils of rose, tangerine, cinnamon, ginger, lemon, and orris. It resembles nonyl alcohol in general properties, but has a much more powerful odour of the rose type. It is useful in preparing some rose compounds, and may be also employed in compounding synthetic neroli. Great care is required in its use, as an excess in any perfume will produce a peculiar and objectionable sharp odour. As a general rule 1 per cent should not be exceeded, and much less will be found sufficient in many compounds. The keeping properties of pure aldehyde C_9 are not good, but it may be conveniently preserved in 10 per cent solution with absolute alcohol and storing in well-filled amber-stoppered bottles. Nonyl aldehyde is prepared synthetically, starting from castor oil. By fractional distillation undecylenic acid is obtained, this is converted into potassium nonylate, nonylic acid, nonyl alcohol, and finally nonyl aldehyde. A complete account of the synthesis will be found in an English periodical.¹ It is known also as pelargonic aldehyde. S.G., 0.827 ; B.P., 192° C.

¹ "P. and E.O.R.," 15 (1924), 12.

Nonyl Iso-butyrate, $\text{CH}_3 \cdot (\text{CH}_2)_7 \cdot \text{CH}_2\text{OOC} \cdot \text{CH} \cdot (\text{CH}_3)_2$, is a liquid of intense rose odour of fruity type. S.G., 0.861.

Nonyl Lactone is an oily liquid having a fine odour reminiscent of coco-nut. It has the formula C_8H_{16}  and is erroneously known as aldehyde C_{18} or cocoaldehyde. It is an indispensable constituent in gardenia and tuberose perfumes, while traces are useful in fancy compositions.

Nuanua Oil was distilled by Schimmel & Co.¹ from the leaves of a species of *Nelitris*, Gärttn, a tree or shrub of the family Rubiaceæ growing in Samoa. It was a greenish-yellow liquid having an odour reminiscent of ambergris. Steam distillation yielded an oil having the finest odour.

Nutmeg Oil is distilled generally from the small and damaged seeds of *Myristica fragrans*, van Houtt, a tree of the N.O. Myristicaceæ, indigenous to the Molucca Islands and grown also in Java, Sumatra, Penang, Ceylon, etc. During growth, the nutmegs are enclosed in a thin pericarp which is surrounded by an arillus (mace), the whole being contained in a fleshy drupe. To remove the pericarp the seeds are dried artificially when the kernel is easily extracted. In order to protect them from attack by insects they are "limed" either by immersion in milk of lime or by dusting with slaked lime. They are exported in cases and on arrival in this country are sieved according to size. The sound and bold specimens are seldom sold for distillation but generally enter the market as a spice. The yield of essential oil of nutmeg to distillation is from 7 to 15 per cent. Mace (the arillus) yields a similar percentage but this is not often met with in commerce. When the seeds are subjected to hot pressure they yield about 20 per cent of a concrete oil² which melts about 45°C . and is highly aromatic. It contains about 12 per cent of volatile oil

¹ "Report" (November, 1908), 136.

² Often erroneously referred to as *oil of mace*.

together with resin and glyceryl myristinate. The following constituents have so far been identified in nutmeg and mace oils: eugenol, iso-eugenol, terpineol, borneol, linalol, geraniol, safrole, an aldehyde, terpenes and free acids. Expressed oil of nutmeg is used in perfumes for obtaining a spicy odour, and in lavender water for imparting a special characteristic which is altogether pleasing and difficult to copy. The yellow essential oil is much used as a flavour for dental creams in combination with peppermint, methyl salicylate, cloves, etc. It is also employed as a tobacco flavour, being blended with cassia, cloves, vanilla, coumarin, etc.

Oakmoss Resin or Mousse de Chêne is obtained by the volatile solvent process from *Evernia prunastri*, Ach., and *E. furfuracea*, Ach., lichens belonging to the family Parmeliaceæ and found growing on oak, spruce, and sometimes fruit trees. It is collected principally in the mountainous districts of France (Central Alps and forest of Fontainebleau), Czecho-Slovakia, Herzegovina, and Italy (Piedmont), and is there pressed into large bails before being transported to the perfumery works for extraction. The characteristic musk-lavender odour is not very pronounced in the lichen. From its colour and appearance it is possible to tell which trees it has grown on. That obtained from oak is greenish, and that from spruce greyish and the underside blackish. Sometimes *Stecta pulmonacia* is found as an admixture, but this is rarer than quantities of *Ramanila farinacæ*, *R. fraxinæ*, and *R. pollinaria*. The product obtained by volatile solvents is concrete, and consists largely of chlorophyll together with resin and volatile oil. The absolute is obtained from this concrete by the usual methods. The volatile oil is extracted from the concrete by treatment with acetone which leaves behind the resin, wax and chlorophyll. It is also made by one firm by direct steam distillation of the lichen. The colourless absolute is the most esteemed in perfumery, but it is desirable when trying this product to make quite sure that the separation

of the colour has not in any way impaired the odour of the sample. Oakmoss was first examined by M. Gattefossé¹ who isolated a phenol which he named "lichenol" by distilling an extract prepared with volatile solvents. According to Walbaum and Rosenthal² this substance should be orcinol monomethyl ether. Recently another examination has been made by Alex St. Pfau³ who has shown lichenol to be identical with the ethyl ester of evernic acid.

Oakmoss is now one of the indispensable raw materials of the perfumer, but there are few chemists who will not have noticed the great differences in odour of the numerous products of various manufacturers. This multiplicity of types is due to the diversity of botanical origins, the proportions in which they occur in the moss of commerce, to their place of origin and collection and to the mode of extraction of the substances themselves. This problem is complicated by the fact that most of the constituents of the oakmoss re-act upon the solvent, particularly so in the case of alcohol which alters the evernic acid. The whole aspect of this problem has, however, been fully discussed elsewhere, and interested readers are referred to a well-known French periodical.⁴

As a rule it may be said that the presence of *spruce* moss is the most deleterious to the odour since it imparts a distinct pinaceous character.

Oakmoss is an excellent fixative for bouquets of the "poppy" type. It blends well with coumarin, amyl and isobutyl salicylate, ylang-ylang, methyl acetophenone, and lavender and is an excellent basis for chypre and fougère compounds. In small quantities the best quality products are indispensable for perfuming face powders in combination with jasmin, tuberose, and orange blossom absolutes.

¹ "La Parfumerie Moderne," 4 (1911), 6.

² "Report" of Schimmel & Co. (1925), 58.

³ "Les Parfums de France," 16 (1924), 137.

⁴ "Les Parfums de France" 34 (1928), (English parallel translation).

In soap perfumery oakmoss will strengthen, improve, and cheapen lavender bouquets. Oakmoss is believed to have played a part in the commerce of antiquity,¹ for in ancient Egypt this lichen was an ingredient in bread making. It has been discovered in the tombs of the Pharaoh period, where baskets made of rushes were filled with both *Evernia furfuracea* and *E. prunasiri*. These lichens do not occur in Egypt, where lack of moisture prevents their growth, but in the last century Forstal saw several consignments being unloaded at Alexandria. These had been shipped from the Islands of the Archipelago. An example of the application of oakmoss absolute in a chypre perfume is appended :—

50	Oakmoss absolute.
30	Patchouli.
20	Vetivert.
150	Rose rouge.
30	Jasmin absolute.
10	Cassia absolute.
300	Bergamot.
100	Sweet orange.
10	Angelica root.
100	Coumarin.
30	Vanillin.
20	Musk ambrette.
120	Methyl ionone.
30	Eugenol.
<u>1000</u>	

When blending oakmoss the following points should be borne in mind. To obtain :—

Freshness—bergamot, lemon, linalol, linalyl acetate, citronellyl formate.

Lightness—alpha ionone, hydroxy-citronellal.

Floral—jasmin, rose, cassie, orange blossom.

Tone—ylang, coriander, sweet orange, tarragon, sassafras, vanillin.

Stability and depth—patchouli, vetivert, coumarin, musk.

Ocimum Basilicum—see Basil Oil.

¹ For a full account, see "La Parfumerie Moderne" (1922), 227.

Octyl Acetate, $\text{CH}_3 \cdot (\text{CH}_2)_7 \text{OOC} \cdot \text{CH}_3$, has been found naturally in the oil distilled from the seeds of wild parsnip. It may be artificially prepared, and is a colourless liquid possessing an odour recalling that of orris with a backing of orange and jasmin. Traces are useful in synthetic rose, neroli, cassie, and jasmin. Some eau-de-Colognes are enhanced by traces of this body. S.G., 0.873; B.P., 205°C .

Octyl Alcohol, $\text{CH}_3 \cdot (\text{CH}_2)_6 \cdot \text{CH}_2\text{OH}$, the normal alcohol, probably occurs in cow-parsnip oil. It may be synthetically prepared, and is a liquid with a peculiar sharp odour. It is used in the jasmin type of perfume, about 1 per cent being sufficient for ordinary blends. Up to 5 per cent may be used for modifying fancy bouquets. S.G., 0.827; B.P., 191°C . It is also useful in Colognes.

Octyl Aldehyde, $\text{CH}_3 \cdot (\text{CH}_2)_6 \cdot \text{CHO}$, occurs naturally in the oils of lemon, rose, and orange flower. It has a rather sharp, powerful odour, and is useful for giving a special note to perfumes of the jasmin, orange, and rose type. S.G., 0.821; B.P., 175°C .

Octyl Benzoate, $\text{CH}_3 \cdot (\text{CH}_2)_7 \text{OOC} \cdot \text{C}_6\text{H}_5$, is an oil having a softer odour than the other octyl esters. It is a good fixative. S.G., 0.967; B.P., 305°C .

Octyl Butyrate, $\text{CH}_3 \cdot (\text{CH}_2)_7 \text{OOC} \cdot \text{C}_3\text{H}_7$, has been found in the rhizome of male fern. It is an oil with a heavy fruity odour and is not much used, excepting as a modifier. S.G., 0.868; B.P., 244°C .

Octyl Formate, $\text{CH}_3 \cdot (\text{CH}_2)_7 \text{OOC} \cdot \text{H}$, is a liquid having a more pungent odour than the acetate. It is used in traces as a modifier. S.G., 0.880; B.P., 198°C .

Octyl Heptylate, $\text{CH}_3 \cdot (\text{CH}_2)_7 \text{OOC} \cdot \text{C}_6\text{H}_{13}$, is a colourless oil having a heavy fruity odour. It is employed in traces as a modifier.

Octylidene Acetone, $\text{C}_7\text{H}_{15} \cdot \text{CH} : \text{CH} \cdot \text{CO} \cdot \text{CH}_3$, is a powerful oil which may be used in fancy jasmin perfumes.

Octyl Iso-butyrate, $\text{CH}_3 \cdot (\text{CH}_2)_7 \text{OOC} \cdot \text{CH} \cdot (\text{CH}_3)_2$, is a liquid having similar properties to the normal butyrate. S.G., 0.861 ; B.P., 100°C . at 5 mm.

Octyl Methyl Ketone, $\text{CH}_3 \cdot (\text{CH}_2)_7 \cdot \text{CO} \cdot \text{CH}_3$, is a liquid having a powerful odour of nondescript type which combines well with oakmoss, heliotropin, and vanillin as a base for face powder odours.

Octyl Propionate, $\text{CH}_3 \cdot (\text{CH}_2)_7 \text{OOC} \cdot \text{C}_2\text{H}_5$, is an oil having an odour recalling mushrooms with a raspberry nuance. Novel effects are obtained with it in carnation, jonquille, and reseda bouquets. This ester has been found to occur in nature in the oil distilled from the dried fruits of *Pastinaca sativa*, L. S.G., 0.872 ; B.P., 226°C .

Octyl Valerianate, $\text{CH}_3 \cdot (\text{CH}_2)_7 \text{OOC} \cdot \text{C}_4\text{H}_9$, is an ester of intense fruity odour. Used in flavouring essences. S.G., 0.862 ; B.P., 250°C .

Æillet is the name frequently given to carnation flower oils. They are mixtures of synthetics, with either eugenol or iso-eugenol as the base (*which see*).

Ænanthic Ether is ethyl heptoate.

Ænanthylic Aldehyde—*see* Heptylic Aldehyde.

Ænanthylidene Acetone—*see* Heptylidene Acetone.

Olea Fragrans, Loureiro, also known as *Osmanthus fragrans*, Thunb., is an evergreen tree attaining sometimes a height of 20 feet when fully grown and belonging to the N.O. Oleaceæ. It is a native of the Far East, where it is cultivated for the sake of its sweet perfumed flowers called "Kwei Hwa" or Mo Hsi. These blow in the autumn and resemble clusters of lilac in appearance. In odour they are of the jasmin type and are used as a flavour in tea. Some, however, are preserved by immersion in a solution of alum. In this condition they are sold to confectioners and

bakers who first wash them in running water and then steep them in syrup until required for use.

Oleic Acid, $C_{17}H_{33}.COOH$, is, when purified, a yellowish syrupy liquid which solidifies in the cold. It has a slight odour of tallow, and is prepared by the saponification of oleins (tallow, lard, etc.), the soap formed being decomposed with a mineral acid. The solid acids, stearic and palmitic, are removed by cooling and expression. Oleic acid is used in certain vanishing creams.¹

Oleyl Alcohol, $C_{17}H_{33}OH$, is a colourless, inodorous, viscous liquid which has remarkable properties and possibilities as a constituent of cosmetics. One per cent added to the fatty acids before saponification in a toilet milk or vanishing cream will impart a beautiful soft texture and pearliness, unobtainable with any other raw material.

Olibanum is a gum-resin obtained from *Boswellia Carterii*, Birdw., and other species² of the N.O. Burseraceæ, by making incisions into the inner bark of the tree. It occurs in the form of round or ovate tears, which vary in size from one-eighth to about one inch in diameter. They are colourless to pale yellow, possess a characteristic balsamic odour, and yield from 5 to 10 per cent of volatile oil. Only about 60 per cent of the gum-resin is soluble in 90 per cent alcohol, the insoluble portion consisting principally of calcium and magnesium arabinates, with some bassorin. The trees grow in the torrid regions of East Africa near Cape Gardafui and on the southern coast of Arabia. It appears from the accounts of various African travellers that they grow on the barren limestone rocks and are never found in sand or loam. The highly aromatic resin permeates the leaves and bark of the tree and even exudes as a milky juice from the flowers. The clearest account of

¹ Consult an article by the author in "La Parfumerie Moderne" (1924), 6; "American Perfumer" (1925), 17; "Pharmaceutical Journal" (1925), 441.

² For these, together with a detailed history, consult the author's paper in the "American Perfumer" (July, 1924), 255.

its collection is given by Cruttenden¹ who visited the Somali country in 1843. About the end of February or beginning of March, the Bedouins visit all the trees in succession and make a deep incision in each, peeling off a narrow strip of bark for about 5 inches below the wound. This is left for a month when a fresh incision is made in the same place but deeper. A third month elapses and the operation is again repeated after which the gum is supposed to have attained a proper degree of consistency. The mountain sides are immediately covered with parties of men and boys who scrape off the large clear globules into a basket while the inferior quality that has run down the tree is packed separately. The gum when first taken from the tree is very soft but hardens quickly. Every fortnight the mountains are visited in this manner, the trees producing large quantities as the season advances, until the middle of September when the first shower of rain puts a close to the gathering that year. Carter's description of the collection of the gum-resin in Arabia is similar, excepting that he says the incisions are made in the months of May and December and the first exudations are milky white. Olibanum is also known as **Frankincense** and **Gum Thus**, but the latter description in the drug trade is held to mean the oleo-resin which is scraped off the trunks of *Pinus palustris*, N.O. Coniferæ, a tree grown in Central America. The leaves of *Humea elegans* emit an odour having a predominating note reminiscent of olibanum.

Olibanum is widely used in the preparation of incense and fumigating preparations. In perfumery it is esteemed for its marvellous fixative properties, being employed in comparatively large proportions as a basis for face powders, perfumes, and for the heavy Oriental type of scent, while in traces it is recommended for champaca and genet floral ottos. A convenient form in which to employ this valuable natural product is as a strong alcoholic extract (1 in 2), the gum-resin being reduced to powder before maceration. An

¹ Fluckiger and Hanbury's "Pharmacographia" (1879), 157.

excellent fixative base for Oriental perfumes is made with this alcoholic extract as follows :—

150	Olibanum R.
200	Benzoin R.
250	Rose compound.
100	Heliotropin.
50	Coumarin.
50	Vanillin.
50	Musk ambrette.
20	Orris oleo-resin.
20	Iso-eugenol.
10	Labdanum R.
100	Amyl benzoate.
<u>1000</u>	

Those who desire to eliminate the above method of preparation may purchase the colourless product from any of the Grasse manufacturers who make it by the volatile solvent process. One well-known firm uses an improved method of extracting the gum-resin to which they give the name kiou-nouk.

Olivil is the crystalline constituent of the resin of the wild olive. It forms a thick vapour on heating, and has a pleasant odour, resembling that of vanillin. It is employed in Italy for the fumigation of sickrooms.

Opoponax, as met with in commerce to-day, is a gum-resin exuded by *Commiphora erythræa*, var. *glabrescens*, Engler, a plant belonging to the family Burseraceæ¹ and found growing principally in the Ogaden country. It is known also as bissabol, *perfumed* bdellium, *sweet* myrrh, and in Somaliland as habbak hadi—the gum of the hadi tree. It occurs as yellowish-brown lumps having a pleasant and characteristic odour reminding of olibanum, and also reminiscent of a mixture of celery, lovage, and angelica. The greater part of it is exported to China via Bombay, where it is used in religious worship. Opoponax consists principally of gum, resin, and essential oil. The latter

¹ The evidence leading to this conclusion is fully discussed by the author in the "American Perfumer" (May, 1924), 141.

is separated by distillation and is pale yellow in colour. It possesses the characteristic odour of the gum-resin. A resinoid is also prepared by the volatile solvent process. This makes a much finer fixative. Formerly opoponax was probably obtained from some umbelliferous plant whose botanical source was never definitely established. It was attributed to *Balsamodendron kataf*, Kunth., a tree about 20 feet in height and native of Arabia. The opoponax of to-day is much more aromatic and floral in character than its predecessor. Compounds described as opoponax are usually of amber character, this subject being dealt with fully in Volume II.

Orange Flowers—see the monograph in Volume II. and Neroli Oil.

Orange Oil is expressed from the peel of *Citrus aurantium*, L., a small tree of the N.O. Rutaceæ cultivated in countries bordering on the Mediterranean, South and West Africa (French Guinea), the West Indies, and California, etc. Two kinds of oil are met with in commerce—the sweet from *C. Aurantium*, var. *dulcis*, L., and the bitter from *C. Aurantium*, var. *amara*, L. Of these the former is the more important, although in odour and composition they differ very little the one from the other. The principal seat of the orange oil industry is in Sicily, and the Calabrian belt, although recently African and Californian oils have taken a prominent place together with the cheaper West Indian oil. In Europe the oil is produced by expression on similar lines to that described under lemon oil. In the case of the sweet fruit, however, the pulp is of no value for the extraction of citric acid. The bitter orange, on the contrary, yields a juice containing from 2 to 5 per cent, but this is only extracted when a citrate plant is within easy reach. The African oil possesses a very fine odour and is competitive with the former. The Californian oil appears to be the product of distillation and in odour and taste differs from those already described. The West Indian oil is obtained largely from sweet oranges, and



Antoine Chiris.

FIG. 37.—Terraced Orange Trees near the Gorge de Loup.

[To face page 310.

second grade fruit may be used for the purpose. The peel is removed by a specially constructed machine and in a finely divided condition is distilled with water *in vacuo*. According to Hood¹ the resultant oil is mixed with 20 per cent of its weight of fresh unextracted rind, macerated and filtered. This improves the colour, odour, taste and brilliance of the finished product. The principal constituent of orange oil is limonene together with small quantities of linalol, terpineol, citral, citronellal, methyl anthranilate, nonyl alcohol, and decyl aldehyde. This oil is often used in the manufacture of eau-de-Cologne when it will effectively replace neroli oil in part. It is appreciated in certain fine perfumes such as chypre, and large percentages are used in brilliantine compounds. It is also used as a tobacco and dental flavour, and occasionally in the soap industry. The terpeneless oil has a delightful aroma, and in combination with terpeneless petitgrain oil will make an excellent base for cheap eau-de-Cognes. Those readers who are interested in the East African oil, will find a good account of this new industry in a well-known French periodical.²

Orchidée is a name given to perfumes of which either amyl or iso-butyl salicylate is the base. They are very similar to trèfle compositions (*which see*). A reference should also be made to the monograph on Orchids in Volume II.

Oregon Balsam Oil—*see* Douglas Fir Oil.

Origanum Oil is obtained by distillation from one or other of the following species of the N.O. Labiatae which are distributed over the countries bordering on the Mediterranean. They have been identified by botanists as follows :—

Algerian—*Origanum floribundum*, Mumby.
O. cinereum, de Noe.

¹ Bulletin 399, U.S. Department of Agriculture.

² "Parfums de France" (1932), 153.

Cretan—*O. onites*, L., *O. maru*, L.

Cyprian—*O. majoranoides*, Willd.

O. Bevani, Holmes.

Smyrnian—*O. smyrnoem*, L.

Triestian—*O. hirtum*, Lk.

Europe Generally—*O. vulgare*, L. (also called wild marjoram).

It is probable that other varieties not yet known with certainty are added to the above in the distilling apparatus. An extraordinary divergence in composition has been observed in these oils ; sometimes thymol is found, sometimes carvacrol and often both. In commerce origanum oil is sometimes white or yellowish and sometimes red. This may be accounted for by the one being re-distilled and the other crude Spanish thyme oil. The following bodies have so far been identified in origanum oils from various sources : carvacrol, thymol, linalol, cedrol, cymene, pinene, and origanene.

Orris Absolute is obtained from orris rhizomes by the volatile solvent process. It is a liquid having an intense violet odour, and for fine perfumery is to be preferred to any other product from this source. It is of course the most expensive and well worth the money.

Orris is the rhizome of *Iris germanica*, *I. pallida*, and *I. florentina*, N.O. Iridaceæ, collected in the latter part of the summer, peeled, and dried in the sun. All three species are widely cultivated on the northern shores of the Mediterranean and other parts of Europe, Morocco, etc. The best quality roots are obtained from *Iris pallida* in Tuscany, and principally constitute the Florentine orris root of commerce. It is, of course, well known that *Florentine* rhizome is not synonymous with the root of *Iris florentina*, but includes all three varieties.

According to a writer in an English periodical ¹ the most

¹ " P. and E.O.R. " (1922), 270.

renowned district for the cultivation of iris is that of which the village of San Polo is the centre. Here practically every farmer grows iris as one of his crops, and from it he obtains the flowers, bulbs, and roots. The bulbs arise from the "eyes" that develop in the root, and vary in number according to whether the plant is a two-year or three-year plant. They are used exclusively for reproduction, and for this purpose they are removed from the root in such a way as to leave a part of the root still adhering to them, as otherwise they are useless. The flowers are sold for ornamental purposes; the seeds do not reach maturity, and after cutting the flowers the root undergoes more rapid development and becomes richer in its aromatic principle.

"In San Polo the fields given over to iris have a southern aspect to ensure the greatest amount of sunshine. As soon as the previous crop is cleared up, the ground is harrowed and then levelled off. By the middle of September the bulbs are ready for planting. A man digs small trenches about 4 in. deep and 12 in. apart; he is followed by a boy who plants the bulbs about 10 in. apart in the trenches, and great care must be taken in this operation to see that the root adhering to the bulb is at the bottom of the trench. The bulbs are covered by the soil thrown up when the next trench is dug. The bulbs used are those gathered in the previous May or June, and about 80,000 are required for each acre of ground. A man and boy can plant about 6000 per day working in the above manner.

"No particular manure is required. Phosphates have been tried without success; it was found that larger leaves only were obtained, whilst dung gives rise to rot. On the other hand, previous crops—specially lupinella—are sometimes dug in and act as manure, whilst this operation also serves to render the soil free from weeds and better adapted for the development of the rhizome.

"The harvest is gathered in June to August, when the season is dry and the roots well developed. The plant is taken up and the rhizome is separated from the bulbs and freed from the roots. The bulbs are laid out in the open,

with a covering of leaves over them, in preparation for their planting in the next season.

“The rhizomes are immersed in clean water to free them from adhering earthy matter, and following this they are decorticated. This operation is called ‘mondatura’ locally and is performed by women provided with small curved knives. Decortication by machinery has been attempted, but owing to the great irregularity in shape of the rhizomes, success has not been achieved so far. The machine consisted of a sharp circular knife, against which the peasant girl placed the rhizome to be decorticated. To anyone acquainted with the work it will be evident that by this means proper decortication can only be obtained with great waste of valuable rhizome, whilst economy can only be effected at the expense of incomplete removal of the cortex, so that the operation is done by hand.

“The decorticated rhizomes are again cleaned in water and then exposed on straw mats to dry in the sun. They are occasionally turned, in order to expose different surfaces, and thus effect uniform drying. Desiccation is effected in artificially-warmed and well-ventilated chambers only when the weather is wet. It is customary to leave the rhizomes in the open during clear, calm nights, in order to make them whiter, the result (it is said) of the action of the morning dew. When perfectly dry the rhizomes are ready for sale.

“The labour required for the cultivation is comparatively little during the early stages; the planting of the bulbs and the attention given them does not absorb much labour, which at that time is well occupied in the production of olive oil, wine, etc. In the summer, when the vines and olives require little attention, the iris harvest and the subsequent cleaning and decortivating of the rhizomes absorbs practically all the locally available labour.

“The Florentine hills, in which San Polo is situated, produce by far the greater part of the total production of orris root. In an average season about 300 tons represents the San Polo production, an acre of land yielding about 1 ton.

“The rhizome is worked up for the various orris products in Milan, Grasse, London, Germany, etc. The manufacture is, however, chiefly centred in Grasse.”¹

In France a limited quantity of *Iris florentina*, L., is cultivated, the principal centre having been established in the department of Ain as early as 1835. Young shoots from two year old rhizomes are planted out in August or September, and the crop of rhizomes collected during the early autumn of the second year. Contrary to the Italian methods the rhizomes are cleaned before being soaked in water. They are subsequently dried either by exposure to the sun's rays or by being placed in a warm stove. In 1924 several thousand rhizomes of *Iris pallida* were planted at Sanzet in the department of Drôme and are said to be well established.

Powdered orris root is largely used in *violet powder* on account of its delicate violet perfume. It is also useful in dental preparations, and may be very occasionally employed as a constituent of face powders up to 10 per cent. It is the basis of many violet sachet powders and is also much employed in the manufacture of violet soaps. In such cases it is customary to use some palm oil soap since its odour will enable the manufacturer to economise in perfume. Up to 10 lb. of powdered orris may be added per hundredweight of soap and from 12 to 16 ounces of the following perfume :—

300	Methyl ionone.
200	Ionone, 100 per cent.
100	Linalyl acetate.
120	Terpineol.
10	Cassia.
40	Santal.
100	Cedarwood.
100	Guaiacwood.
30	Musk xylene.
<u>1000</u>	

¹ Another account of the orris industry illustrated with excellent photographs will be found in “Les Parfums de France” (1924), 283, 309, 339.

Orris Oil occurs in commerce as both **Concrete** and **Liquid**. The former is the more popular article, and is obtained by distilling the various powdered rhizomes with superheated steam and condensing the vapours in air-cooled tubes or a worm immersed in water thermostatically controlled at a temperature of about 50° C. to 60° C. The yield of oil is small, only about 0·1 to 0·2 per cent being obtained. This product is a solid fat at normal temperatures and melts about 45° C. Approximately, 85 per cent of concrete oil of orris consists of the completely odourless *myristic acid*, while the remaining 15 per cent is made up of **Irone** (the violet-like ketone), with traces of the esters of myristic and oleic acids, furfural, benzoic, nonylic, and decyclic aldehydes. Recently Langlois and Goby¹ have shown the presence of the following saturated aliphatic acids, octylic, nonylic, decylic, undecylic, duodecylic and tridecylic. A certain quantity of concrete orris is distilled by a much-esteemed English firm. By far the largest proportion of the oil of commerce is produced, however, in the neighbourhood of Grasse, either from rhizomes grown there, or more frequently by distilling the roots imported from Tuscany. These two kinds are easily distinguishable, the French root yielding an oil with a much more delicate violet-like aroma. The Florentine orris, however, produces a far more expensive and odoriferous oil which will go further in blending violet compounds. Gattefossé² suggests the saccharification and fermentation of the roots in order to eliminate the starch and thus facilitate distillation. He states that by this method a higher yield of oil is obtained together with 25 litres of alcohol for every 100 kilos of dry rhizome. **Liquid orris** oil may be one of two kinds, either the natural *concrete* from which the solid inodorous constituents have been separated, or a liquid obtained by distilling orris roots with cedarwood oil (more often direct admixture of the concrete oil with this or other slightly odorous oils). Orris oil is extensively

¹ "P. and E.O.R." (1924), 311; "Les Parfums de France" (1924), 257.

² "Parfumerie Moderne" (1926), 209.

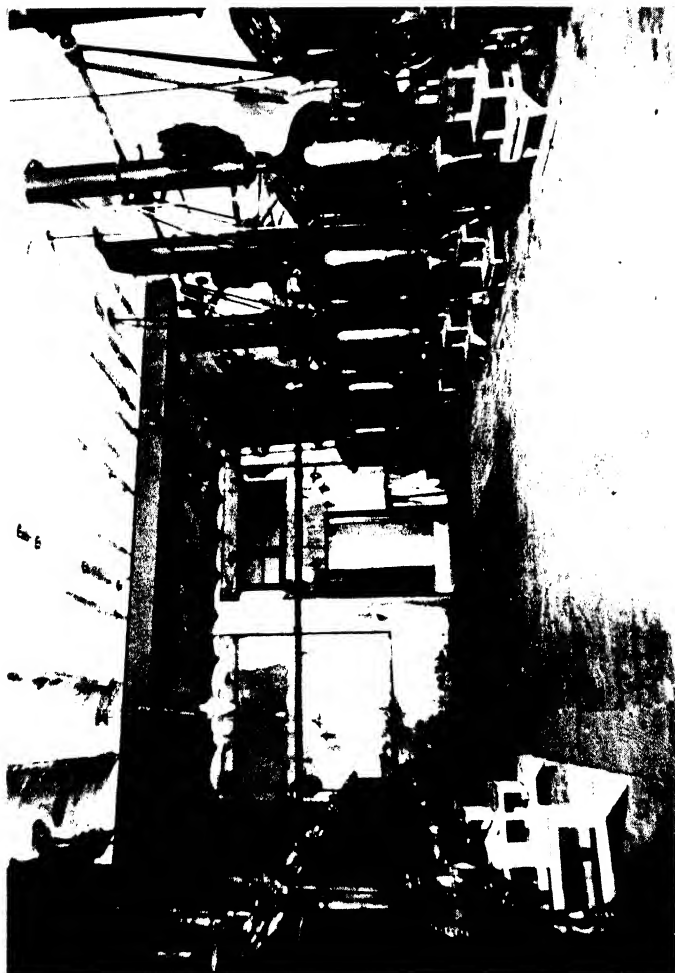


FIG. 38.—Stills for Concrete Oil of Ormis.

[Koure-Bertrand Fils.

[To face page 316.

employed for blending with ionone, as a base for violet compositions. It is also useful in other floral ottos of this type, such as reseda or cassie, and may be used with advantage in opoponax and lavender perfumes.

Orris Oleo-Resin is obtained from the rhizome by extraction with acetone, petroleum ether, or other volatile solvent. It is a remarkable fixative for lavender water, violet perfumes, and high-class soaps.

Orris Resin is an inferior product and is recommended for cheap soaps.

Orseille is cudbear (*which see*).

Os Sepiæ is the calcareous growth obtained from the common cuttle-fish, *Sepia officinalis*, N.O. Cephalopoda. It consists principally of calcium carbonate and is used in tooth powders.

Otto of Rose—*see* the monograph on Rose in Volume II.

Oxycholestrin is a sterol of the possible formula $C_{27}H_{46}O_2$. Its presence has been shown in the spleen and adrenal glands. It also occurs in lanolin from which substance it is prepared by patented processes. The most desirable types are creamy white odourless substances of the consistence of lanolin. They melt at about $40^{\circ}C$. and are capable of absorbing up to five times their own weight of water or water-soluble ingredients. This property is made use of in the production of skin creams, besides which oxycholestrin bases are valuable as nutritives by virtue of their sterol content. As a rule 65 per cent aqueous and 35 per cent base makes a desirable balance although the water content can be increased if desired, but then there is a risk of separation under variable storage conditions. The addition of 5 per cent of white beeswax will increase the firmness of the cream at the expense of the fineness of the emulsion. The use of saponifying agents such as borax is unnecessary. Manipulation is preferable at a temperature just above that of the melting-point of the

ingredients. Lecithin 2 per cent and cholestrol $\frac{1}{2}$ per cent are useful additions in skin food types of cosmetics. A 50 per cent emulsion of oxycholestrin with water, suitably perfumed, makes an excellent sunburn cream, a tan being produced without burning the skin.

Oxyquinoline Sulphate, $(C_9H_7NO)_2H_2SO_4$, is a yellowish crystalline powder having a slight odour reminding of saffron. It is readily soluble in water and melts at 175° to 178° C. Its analgesic, non-toxic, and powerfully antiseptic properties are utilised in the preparation of solid deodorants, up to 3 per cent being employed.

Ozokerite is the crude wax used in the preparation of ceresine (*which see*).

Pachak—*see* Costus.

Pæonol is a ketone having the formula $C_9H_{10}O_3$ (*p*-methoxy-*ortho*-hydroxyphenyl ketone), and has been identified in the oil from *Pæonia Montana*.

Palmarosa Oil is produced in India by the distillation of the grass *Cymbopogon martini*, Stapf., N.O. Graminaceæ, of which there are two kinds, "Motia" and "Sofia." The name *Rusa* grass is applied to both varieties by the natives, the former being most esteemed (motia = precious, sofia = mediocre) on account of its yielding palmarosa oil. The latter is the source of ginger-grass oil. These grasses are very widely distributed, but they are worked for palmarosa oil principally in the provinces of Berar and Khandesh, and in particular in the district of Amroati of which Ellichpur is the centre. The grass begins to bud towards the end of August and flowers during September and October. Distillation is carried on during this period, the earlier collections producing a higher yield of superior oil. The major portion of this oil is distilled in the Bombay Presidency and the central provinces, comparatively crude apparatus being used. The natives employ copper or iron cauldrons which are built into stone fireplaces on the banks of streams. A loose lid fits on the cauldrons which are from

2 to $2\frac{1}{2}$ feet in diameter. Through the lid passes an elbowed bamboo tube about 6 feet in length which connects with a copper receiver. This is immersed in the stream and held in position with a wooden framework and stones. A roof is generally built over each battery of stills.¹

The grass is trampled down in the cauldron containing about 1 foot of water, the lid placed in position and jointed securely with a mixture of mud and flour. The bamboo tube is next luted into the lid and connected with the receiver, the neck of which is secured. Fire is placed under the still, the oil passing over from each charge in two or three hours. The oil in the receiver is separated. That from each small distillery is mixed together and sent to Ellichpur—the principal trade centre. That for export eventually finds its way to Bombay.

For many years palmarosa oil entered Europe via Turkey, and this appears to account for the appellation "Turkish Geranium Oil." It is a colourless to pale greenish-yellow liquid, with a soft sweet odour recalling rose-geranium. It is the source of the finest commercial geraniol, which occurs to the extent of from 75 to 90 per cent. Schimmel & Co.² have examined oils distilled in Java, which showed a high geraniol content.

In addition to this palmarosa oil contains geranyl acetate and capronate, dipentene, methyl heptenone,¹ and farnesol. Quite a considerable amount of the oil was at one time used as an adulterant of Bulgarian rose otto. According to Pearson³ it was prepared especially for this purpose by shaking with gum-arabic solution with subsequent exposure to the sun. By this means the oil gets lighter in colour and agrees in this respect better with rose oil. The comparatively cheap price of good palmarosa oil, together with its rosaceous bouquet, make it an excellent

¹ Several excellent photographs supplied by Burkill were published in the "Reports" of Schimmel & Co., October, 1909, and April, 1910.

² "Report" (1914-15), 32.

³ Schimmel's "Report" (1917), 31.

and indispensable raw material for soap perfumery. It blends well with clove, cassia, and patchouli oils, terpineol, benzyl acetate, coumarin, and musk. For superlatively excellent results it is desirable to blend it with Algerian geranium oil.

An orange-coloured oil is distilled from *Cymbopogon intermedius*, Stapf., a grass found in India, China, Java, etc. It has an odour recalling that of vetiver.

Palmitic Acid, $C_{16}H_{31} \cdot COOH$, is a white crystalline substance which, when pure, melts at $63^{\circ} C$. It is found associated with other fatty acids, and as the glyceryl ester, in most of the harder fats and vegetable oils, particularly palm oil. Palmitic acid is not obtainable commercially in the pure state but is sometimes used instead of stearic acid in the production of vanishing creams.

Palo Santo is the name given by the natives of South America to holy wood, *i.e.* guaiacwood (*which see*).

Pandanus Oil is obtained from the flowers of *Pandanus odoratissimus*, L., N.O. Pandanaceæ, a plant growing in India, Arabia, and Persia. It is stated to have a very pleasant, honey-like odour. The flowers are often distilled with sandalwood and are said to retain their fragrance when dry—*see* Kewda Oil.

Para-Cresol—*see p-Cresol*.

Para Tertiary Butyl Meta Cresol is a powerfully odorous viscous yellowish liquid, having an odour of Russian leather. It is infinitely superior to birch tar oil even when highly rectified. As a base for Cuir compounds it is unique.

Paraffin Liquid is a purified, clear, oily liquid obtained from petroleum after the more volatile portions have been removed by distillation (at about $370^{\circ} C$). It is usually sold according to gravity, the oil about 0.890 having a considerable vogue in medicine. For cosmetics the inodorous liquid from 0.860 to 0.885 is largely employed, particularly

in cheap cold creams, brilliantines, etc. Some oils exhibit a slight fluorescence, which is of no consequence in cheap cold creams. All these white oils may be obtained having different viscosities, a point which should not be lost sight of when buying.

Paraffin Molle or **Soft Paraffin** is a semi-solid mixture of various paraffin hydrocarbons, usually obtained by purifying the residue obtained when crude petroleum is distilled and the fraction which distills between 360° and 390° C. has been separated. Soft paraffin may be yellow or white and should melt about 38° to 46° C. It is largely used in pharmacy as an ointment base, while it may be employed in cosmetics in the preparation of various toilet and massage creams.

Paraffin Wax or **Hard Paraffin** is a mixture of the harder members of the paraffin series of hydrocarbons. It is prepared from the crude tarry oil obtained by the destructive distillation of shale when it is known as *pyroparaffin*. That obtained from the Pennsylvanian oil-fields is known as *protoparaffin*. The former solidifies from 43° to 50° C. and the latter from 48° to 56° C. It is a colourless, semi-transparent, inodorous body, and is employed in preparing several toilet articles, notably lip-salves.

Paraphenylene Diamine, $C_6H_4(NH_2)_2$, occurs as colourless crystals in the pure state, melting at 147° C. but soon becoming discoloured on exposure. It may be prepared by the reduction of aminoazobenzene with tin and hydrochloric acid, aniline being formed. "Para" should be stored in amber glass vessels, and when made into solution should be stored in coloured glass bottles. This substance is well known in the hairdressing trade as one of the most successful hair-dyes, being, however, attended with a certain amount of risk. Its use depends upon its oxidation to Bandrowski base which is effected usually with hydrogen peroxide. For details of its application, etc., Vol. II. should be consulted.

Parsnip Oils are distilled from different parts of the plant *Pastinaca sativa*, L., belonging to the N.O. Umbelliferæ. That from the fruits has a characteristic odour and contains octyl butyrate; that from the umbels without fruits has an odour reminding of ambrette seeds, and that from the roots contains vanillin and is reminiscent of vetivert.

Passion Flower.—The common passion flower, *Passiflora coerulea*, N.O. Passifloraceæ, is cultivated for its gorgeous flower. It is one of an extensive genus of climbing shrubs, the greater number of which are natives of Brazil and the West Indies. One of the finest shows of this flower the author has seen in Europe is cultivated by Mr. Fred Firmenich at his beautiful Lakeside residence, Le Mailly, near Geneva. *P. alata* has an exquisite fragrance.

Patchouli Camphor is an odourless constituent of patchouli oil, from which it separates in crystals that melt at 56° C. This only occurs in very old oil.

Patchouli Oil is a powerfully odorous viscid liquid obtained by distilling the dried leaves of *Pogostemon patchouli*, Pellet. (*P. Patchouli*, var. *Suavis* Hooker, *P. Cablin*, Benth.), and other species of the N.O. Labiatae. The plant is cultivated in India, the Philippines, Java, Sumatra, and Singapore, where a large proportion of the oils of commerce are distilled by three Chinese firms. For this purpose the genuine non-flowering patchouli leaves known locally as *Tilam Wangi* and *Dhalum Wangi* are employed. These are subject to adulteration with wild patchouli, a form of *P. Heyneanus*, Benth., *Urena lobata*, L., and *Hyptis suaveolens*, L. It is said that 90 per cent of patchouli leaves exported from Singapore, do, in fact, come from the interior of Northern Sumatra. The cultivated plant is a herbaceous perennial attaining a height of about 3 feet. Propagation is by means of stems cut just below the node and raised in nursery beds. These are subsequently transplanted to the fields where the ground has been properly prepared, but occasionally the Chinese use forest land which has been recently cleared. The

leaves are sufficiently developed after four or five months for the first cutting. Subsequently they are cut every few months, but the exact period depends upon atmospheric conditions. After about two years the plants require to be renewed. According to the researches of de Jong¹ the highest oil content is found in the first three pairs of leaves (the most recently developed). Thereafter the oil content does not increase even though the leaves become larger. De Jong therefore suggests the first cutting should be as soon as five pairs of leaves have developed. The leaves are dried by exposure to the sun and frequently turned over to ensure even distribution. Sometimes they are allowed to ferment slightly. Dried or fermented leaves yield $2\frac{1}{2}$ to 3 times (calculated as fresh) the quantity of oil. Fermentation appears to improve the Javanese oils, whereas it has no effect upon those distilled in Singapore.

Distillation is by means of direct steam supplied by a boiler which is generally connected with several stills. These are made of iron and are cylindrical being 6 or 8 feet high and about 3 feet wide. For complete distillation a charge of 2 piculs ($2\frac{1}{2}$ cwt. approx.) takes about twenty-four hours. By varying the process some firms are said to obtain four different grades of oil. These are known as "ordinary" and "medium" and correspond to the commercial Singapore oils; those described as "special" and "extra special" approximate closely oils distilled in Europe. Very fine products are also distilled in England and France from imported leaves. Patchouli oil is said to be adulterated with cubeb and cedar oils, while an inferior oil obtained from *Microtana cymosa*, Prain., a herb cultivated in Assam, has been offered as the genuine article. The following constituents have been identified so far in genuine patchouli oil: patchouli alcohol (so-called), cinnamic aldehyde, benzaldehyde, eugenol, an alcohol and a ketone. Patchouli oil is one of the finest fixatives known for the heavy type of perfume such as amber, chypre, fougere, etc., and in

¹ "Teysmannia," 1906 and 1909, through Schimmel & Co.'s "Reports," November, 1908, and October, 1909.

traces is useful for compounding white rose bouquets. It is also largely employed as the basis of toilet powder perfumes, of which the following is a typical example :—

80	Patchouli oil—English.
30	Ethyl cinnamate.
240	Rose synthetic.
50	Linalyl acetate.
20	Anisaldehyde.
100	Jasmin synthetic.
50	Heliotropin.
150	Coumarin.
50	Amber liquid.
200	Benzoin R.
25	Oleo-resin orris.
5	Gamma undecalactone, 10 per cent.
<u>1000</u>	

Allow to mature for one month and then rub down with talc, sift, and store in a bottle. A very small quantity of this is sufficient to give any face powder a sweet, powerful, and persistent perfume.

Patchouli oil is also a very useful soap perfume and will blend well with geranium, palmarosa, clove, and cassia oils, terpeneol, etc. An excellent patchouli soap perfume is made as follows :—

100	Patchouli oil.
200	Santalwood oil.
50	Vetivert oil—Bourbon.
100	Clove oil.
250	Geranium oil—Algerian.
100	Benzyl acetate.
50	Tincture of civet, 3 per cent.
100	Coumarin.
50	Musk ambrette residues.
<u>1000</u>	

Use sparingly.

Patchouli is also extracted with volatile solvents, and a cheap and good resinoid results. This is economical in soaps.

Note.—Valuable Indian shawls used to be distinguished by their odour of patchouli, but since the perfume has

become so common, this test is unreliable evidence of their genuineness.

Peach Aldehyde (so-called) consists mainly of gamma undecalactone.

Peach Lactone is gamma undecalactone.

Peanut Oil—see Katchung Oil.

Peau D'Espagne is a perfume much used for treating leather which is intended for the manufacture of fancy goods. A piece of the material (tanned kid, chamois, etc.) is immersed for about ten days in a mixture such as the following :—

5	Rectified oil of birch tar.
25	Santalwood oil.
20	Bergamot oil.
20	Petitgrain oil.
10	Lavender oil.
5	Clary sage oil.
4	Coumarin.
1	Musk ambrette.
10	Rose synthetic
900	Industrial alcohol.
<u>1000</u>	

At the end of this period it is removed and allowed to drain. It is then spread on a sheet of glass, and after drying is coated with the following mixture by means of a brush :—

150	Amber liquid.
50	Olibanum R.
200	Glycerine.
350	Rose water.
250	Acacia powder
<u>1000</u>	

After being treated in this manner, the leather is pressed under a weight and allowed to dry. This forms the so-called Spanish leather, or perfumed skin, and will retain its odour for years. It is usually sold encased in a fancy silk or satin envelope and when placed in contact with gloves, writing paper, etc., will communicate its perfume to these

objects. The formula given above can be varied at will by the use of such lasting odorous bodies as patchouli, labdanum, and oakmoss.

Pectins occur in ripe fruits and vegetables and embrace a group of compounds which are derived from pectose. For many years they have been employed in jam manufacture and other foodstuffs but quite recently have entered the cosmetic field. Pectins possess all the characteristics of colloids and are alleged to have a beneficial action upon the epidermis. They are readily soluble in water and thus have certain advantages over other vegetable gums. Moreover, they are (1) more stable than many mucilages; (2) good emulsifiers for essential oils; (3) can be diluted with alcohol (under 70 per cent strength) with which they form gels; (4) stable to acids and not precipitated by them. Pectins are, however, decomposed by alkaline carbonates and should therefore be used only with acid or neutral substances. These properties have been made use of in German patents 554084 and 551888. Pectins should make an excellent wave-setting preparation.

Pelargol—*see* Dimethyl Octanol.

Pelargonic Alcohol—*see* Nonyl Alcohol.

Pelargonic Aldehyde—*see* Nonyl Aldehyde.

Pelargonium Oil—*see* Geranium Oils.

Pe-Mou Oil—*see* Coffin-wood Oil.

Peppermint Oil is obtained by distillation from the fresh and sometimes partially dried, flowering tops of different species of the genus *Mentha*, plants belonging to the family Labiatae, and cultivated in England, America, Japan, Italy, France, Germany, etc. The largest proportion of the world's supplies emanate from America and Japan, but since the intrinsic value of this oil lies in its odour and flavour the English product holds the premier position. This fact has from time to time been contested by Continental firms, but the price of any commodity almost invariably indicates its quality (providing there is no



FIG. 39.—A crop of English Peppermint being transported to the stills at Long Melford.
[*Stafford Allen & Sons, Ltd.*
[*To face page 326.*

scarcity) and in this direction the English or Mitcham oil is by far the most expensive.

In England, the principal centres of cultivation are Suffolk, Cambridgeshire, Surrey, Hertfordshire, and Lincolnshire. Several years ago the Surrey industry was centred in Mitcham and the country to the south-west. The migration of the builder, however, has forced the farmers to go further afield, and it seems probable the last of the areas under cultivation will soon disappear. It is of interest to note here that the Reigate Corporation devote 2 acres of their farm to the cultivation of peppermint. In 1925 the crop was sold for £25 per acre. There is also a very fine crop at Banstead.

In England, two varieties of the plant are cultivated : *Mentha piperita*, var. *officinalis* forma *rubescens*, Camus, the black mint, having a purplish stem, midrib and leaf margin, and *M. piperita*, var. *officinalis* forma *pallescent*, Camus, the white mint, having a greenish stem, etc. The former is more widely cultivated, being more robust and yielding a greater quantity of volatile oil.¹ The plants are propagated by roots planted out in the open fields on prepared ground in March and April. In the second year they yield the best oil providing there has been plenty of sun. The plants continue to thrive for about five years and are then replaced by new ones. The crop is collected towards the end of August or the beginning of September, just before the buds open. The plants are partially dried before being transferred to the distilling apparatus. The modern stills of our largest manufacturers take a charge of up to 1½ tons. Water or direct-steam distillation are employed and the process completed in from four to six hours. The yield of oil varies, up to 0·4 per cent having been obtained from the fresh herb. In Australia, black mint obtained from the Mitcham district of England was first planted at Yarloop in 1920. In the following two years excellent

¹ Those readers desiring to study the botany of the *Mentha* genus should consult the detailed treatise by A. and E. G. Camus in the "Bulletin" of Roure-Bertrand Fils, October, 1911, pp. 3-35.

crops were collected, which on distillation yielded oils having a menthol content of 59 and 65 per cent respectively. In 1924 two transplantations were effected, the one to Byford near Perth, and the other to Mount Barket near Albany. The latter gave an oil containing 75.5 per cent menthol. All specimens approximated very closely the characteristic Mitcham odour and flavour. If these oils can be produced at a reasonably low cost, there is undoubtedly a good market awaiting them.

In America three kinds of mint are cultivated for the distillation of the oil. According to Henkel¹ these are : *Mentha piperita*, L., *M. piperita*, var. *vulgaris*, Sole, black mint, and *M. piperita* var. *officinalis*, Sole, white mint. These would appear to correspond with those indicated above by Camus, but further researches are being carried out by the holder of the A. M. Todd Fellowship with a view to clearing up the synonymy of the peppermints. So far most authorities agree that the parent plant, *Mentha piperita*, L., is a hybrid resulting from a cross between *M. spica*, L., and *M. aquatica*, L.

The principal centres of cultivation in America are Wayne County, Southern Michigan, Oregon, and Northern Indiana. The black mint is preferred since it is the most hardy plant. Propagation is by roots, and the crop is collected in early September when the plant is in full bloom. It is allowed to dry partially before being distilled. The average yield of oil is about 30 lb. per acre or 0.35 per cent calculated from the fresh herb. Large quantities of American peppermint oil are rectified in England where the consumption is high.

In Japan the peppermint industry flourishes in the districts of Hokkaido, Okayama, and Hiroshima where two varieties of *Meniha arvensis*, var. *piperascens*, D.C., are known, viz. *Akamaru* and *Aomaru*. The former has a reddish-violet stem and yields the finest oil. It is therefore the principal variety cultivated. Japanese peppermint sprouts in the early spring and flowers in the autumn. The

¹ "American Perfumer" (1923), 23.

crop is collected in the early days of September, and after being tied up in bundles, is hung up for drying which takes three or four weeks. Each acre produces about one and a quarter tons of dried herb. Distillation takes place during October and November, plants two or three years of age yielding the highest percentage of oil. After five years the fields are replanted. Two or three kinds of distilling apparatus are in use. They are all crude compared with the modern ones employed by Western civilisation. Generally they consist of a wooden vat containing the herb, placed on an iron pan containing the water. Fire is applied, and the steam passes through the herb and is condensed on an inverted cone. The distillate is carried away to the receiver by a tube through the side of the vat.¹ This crude distillate is used for the production of menthol which is crystallised out in metal containers placed in a freezing mixture, about 45 per cent yield being obtained.

In Italy very fine peppermint oils are now produced from Mitcham plants, and these make a useful substitute for our high-priced English oil.

In France large quantities of English mint are cultivated in the Alpes-Maritimes, and the yield of oil is said to be higher than in Britain. Experiments have recently been conducted with a view to the production in France of oils having the true English bouquet, and according to a Government publication² the most satisfactory results were obtained from plants grown at Rennes, Courances, and Ailly-sur-Somme. Small quantities of peppermint oil are distilled in Germany, Russia, etc. The German oil is said to be of excellent odour and flavour.

The principal constituents are menthol, menthone, menthyl acetate, and menthyl iso-valerate. These are common to peppermint oils from all sources. Different hydrocarbons, etc., are found in oils from different sources.

¹ A complete account of the distilling apparatus, together with diagrams, will be found in Schimmel's "Report" (November, 1908), 214 *et seq.*

² "P. and E.O.R." (1926), 170.

In the forerunnings of the American oil iso-valeric aldehyde is present.

Peppermint oil is largely used as a flavouring agent for all kinds of consumable articles. It has a considerable vogue in medicine, and is probably the most popular flavour for dental preparations. It is sometimes used in toilet waters where traces impart pleasant cooling properties, though menthol is generally preferred for this purpose. It has also a limited application in soap perfumery, where small quantities will sometimes give character to a compound which would otherwise be mediocre.

Pepper Oil is obtained by distillation from the unripe fruit of *Piper nigrum*, L., a climbing plant belonging to the N.O. Piperaceæ. It is indigenous to Southern India but is now cultivated in the East Indies. The principal commercial centre is Singapore. These climbers are grown in gardens having large numbers of trees to which they cling for support and shade. When the berries begin to ripen the whole spike is separated and dried in the sun. As the drying proceeds the berries change from red to black. They are then detached and sorted and constitute the black pepper of commerce. If the fruits remain on the spike until they are fully matured and the outer pericarp removed, the resulting product constitutes the white pepper of commerce. For the production of volatile oil black pepper is ground before distillation with steam. It yields about $1\frac{1}{2}$ per cent of greenish-yellow oil having an intensely pungent odour reminding of cubebs. It contains phellandrene, dipentene, and probably caryophyllene. Black pepper oil has not any wide application in perfumery. It is used mainly in carnation compounds for soaps.

Pergularia is a genus of the N.O. Asclepiadaceæ, consisting of twining shrubs indigenous to China, India, Madagascar, and the Moluccas. Many of the species are highly odorous and on this account are much cultivated. Perhaps the most prized is *P. odoratissima*, known locally

as "Liane Tonquin," and having greenish-yellow flowers, somewhat akin to primroses. The perfume of *Pergularia* is not a commercial article.

Persic Oil is expressed from the kernels of the peach and apricot. It is known in pharmacy as *Oleum amygdalæ persic* and is useful as a basis of cold creams, skin creams in general, and glycerine and cucumber creams.

Peru Balsam is a pathological product obtained from the trunk of *Myroxylon Peregiræ*, Klotsch, a tree attaining a height of about 50 feet belonging to the N.O. Leguminosæ and occurring in vast forests near the Pacific Coast of San Salvador in Central America. According to Preuss¹ the trees are worked for balsam when they attain a girth of 0.6 to 1 metre which is when they are about ten years old. A portion of the bark is first bruised, then the outer layer is carefully peeled off so as to leave the yellow inner bark exposed. The balsam begins to exude from this wound in about five days and is collected on a rag attached to the wounded surface. When this flow stops, the wound is burnt for a few minutes with a torch, when the flow of balsam recommences. In a few days when this ceases, the wound is deeply cut and all the burnt portions scraped off; this operation causes a fresh flow of balsam. This third exudation thus collected is known as "Balsam de Contrastique" or "Contrapique," while the first and second flow, collected on rags, is called "Balsamo de Panal" or "Balsamo de Trapo." Finally, when the "Balsam de Contrastique" ceases to flow, the whole of the wounded bark is removed, bruised, and boiled with water, yielding a third kind of balsam of stronger odour and less value, known as "Balsamo de Cascaro." Commercial balsam of Peru is a mixture of these products in definite proportions. The same operation is then repeated on a higher portion of the trunk and in several places. The yield of balsam is, according to Preuss, very variable, an average product

¹ "Berichte Pharm.," 33, 306, through "Year Book of Pharmacy" (1901), 159.

being 300 lb. from 100 trees. A portion of the balsam is extracted from the rags by boiling with water, in which it sinks when cold ; the rest is extracted by a press which at the same time filters the expressed liquid. Peruvian balsam is not adulterated locally by the producers. The above process is carried out by the Indians early in November or December after the last rains. They work the trees a second year by bruising that bark that was left untouched the previous year. The balsam is clarified in huge tanks and then presents the appearance of black-brown treacle. It consists of two well-marked portions—30 per cent of Peru-resinotannol and the rest aromatic substances. These have so far been shown to consist of the benzoic and cinnamic esters of benzyl alcohol, esters of benzoic and cinnamic acids, free cinnamic acid, coumarin, vanillin, and nerolidol.

According to Drost¹ Peru Balsam has been produced experimentally with every success from trees grown in Surinam (Dutch West Indies), and there appears to be a reasonable prospect of an industry springing up there in the future.

Peru balsam is used in perfumery in its commercial state, but can be more easily manipulated by dilution with an equal volume of alcohol, especially in cold weather. It is now obtainable as a water-white viscous oil and in this form it is preferable in exclusive perfumes. It will blend well with almost any essential oil or synthetic and is an excellent fixative. In this direction it is useful for lotus, heliotrope, magnolia, champaca, and Persian lilac ; it will also impart a peculiar and yet characteristic "warmth" to perfumes intended for face powders. Peru balsam will make a good base for Oriental perfumes when blended with coumarin, vanillin, musk, and civet. It is also a valuable constituent of some soap compounds and of incense.² Peru

¹ Schimmel's "Report" (1925), 122.

² For a complete account of the history of Peru balsam, together with other methods of extracting it and the theory of its formation, consult the author's article in the "American Perfumer" (1924), 427.

balsam is a desirable addition to all perfumes intended for lipsticks owing to its soothing qualities.

Peruol is a substitute for Peru balsam and consists of a solution of benzyl benzoate in castor oil.

Peruscabin is benzyl benzoate.

Petitgrain Citronnier Oil, or lemon petitgrain, is distilled from the leaves and twigs of the *lemon* tree, *Citrus medica*, L., var. *β -limonum*, Hooker filius, N.O. Rutaceæ, and has a pleasant odour quite distinct from that of ordinary petitgrain oil. It contains 24 per cent of citral together with camphene, limonene, linalol, geraniol, and esters. Similar products are obtained from the lime and mandarin, and these are used in the Cologne type of perfume.

Petitgrain Mandarin Oil, or mandarin petitgrain, is obtained by distillation of the leaves and twigs of the mandarin orange tree, *Citrus Mandurensis*, Laur, cultivated in Algeria, Spain, France, Sicily, etc. This oil is distinguished from other petitgrain oils by its high content of basic nitrogenous constituents, amongst which dimethyl anthranilate predominates. The commercial product is a total oil—that is to say, that at the beginning of the distillation, the fractions float on the surface of the water; as distillation proceeds the nitrogenous constituents increase, and the oil becomes heavier and tends to sink to the bottom of the receiver. The predominating note in the odour of mandarin petitgrain oil is undoubtedly that of dimethyl anthranilate, but there is also associated with it a suggestion of fine thyme. With a view to establishing the composition of the total oil Naves¹ undertook a complete examination which resulted as follows :—

Traces of : free acids, phenols, pyrrol, and other
non-saponifiable bases.

1 per cent : methyl anthranilate.

¹ "Les Parfums de France" (1929), 279.

- 56 per cent : dimethyl anthranilate.
 42 per cent : pinene, camphene (?) dipentene, limonene, paracymene.
 2 per cent : terpenic alcohols ($\frac{1}{3}$ rd esters).
 traces of : sesquiterpenes.

The oil has a useful application in both perfumes and soaps, and is remarkably stable and persistent.

Petitgrain Oil is obtained in the South of France, Tunis, Sicily, French Guinea, and Southern Spain by distilling the leaves and sometimes the twigs of the bitter orange tree, *Citrus aurantium*, var. *amara*, L., N.O. Rutaceæ, and in the forests of Paraguay by distilling species called *Ajepu* or *Naranja I.*, which appear to be a variety of the bitter and sweet orange trees. The finest oil is unquestionably that produced in Europe, but unfortunately this is sometimes subject to adulteration. In the South of France the leaves only of the bitter orange tree are preferred and yield an exceptionally fine oil to steam distillation, about 500 kilos being necessary to produce 1 kilo of essence. The American oil has an odour approximating less nearly to that of neroli, but owing to its lower price finds a ready market.

In Paraguay the orange trees grow in patches called *manchones*, where small and often primitive factories are erected for the distillation of the oil. According to A. Chiris¹ the variety known as *Ajepu* is a creeper, but when transplanted to a clearing it develops into a beautiful tree and is then known as *Naranja I.* Locally the trees are thought to be different, but in reality would appear to be the same. They are closely allied to the species grown on the Riviera. The oil from *Naranja I.* is undoubtedly superior to that from the wild tree, but it only represents 5 per cent of the oils produced in Paraguay. The leaves and twigs are gathered by the natives throughout the year, the largest quantities being collected during the winter between October and April. The trees are felled close to the ground, the leaves, twigs, and young fruits being

¹ "Les Parfums de France" (1925), 286.

distilled while the wood is used as fuel for the boiler. The yield of oil per still per day is about 3 litres, which is equivalent to about 0.3 per cent of leaves and twigs. Petitgrain oil is produced in small quantities in Sicily where the apparatus is old fashioned. In price it cannot compete with that distilled in Paraguay. Petitgrain oil contains nerol, geraniol, geranyl acetate, linalol, linalyl acetate, terpineol, dipentene, limonene, pinene, camphene, furfural, pyrrol and possibly methyl anthranilate. Terpeneless French petitgrain oil has an exceptionally fine odour and is sometimes sold as synthetic neroli. It makes an excellent basis for the artificial oil. Paraguay petitgrain oil is much used in the soap industry, its sweet and pleasant bouquet serving as a useful adjunct in the preparation of fancy compounds. It is of course also employed in conjunction with lemon and bergamon oils as the basis of Cologne compounds for soaps. Petitgrain oil also finds extensive use as a perfume for skin creams in which it remains unaltered. For this purpose it is blended with ylang-ylang, ionone, coumarin, etc., as follows :—

300	Petitgrain—French.
100	Ylang-ylang—Bourbon.
50	Lemon.
50	Alpha ionone.
100	Phenylethyl alcohol.
100	Rhodinol.
50	Iso-butyl salicylate.
100	Terpineol.
60	Cinnamic alcohol.
40	Methyl naphthyl ketone.
20	Coumarin.
30	Musk ketone.

1000

Algerian petitgrain oil approximates most nearly to that from France. The common adulterants are Paraguay oil and also linalol and linalyl acetate. Lemon and mandarin petitgrain oils are now available in commercial quantity and offer pleasant variations for experiment.

Petroleum Jelly—*see* Paraffin Molle.

Phellandrene, $C_{10}H_{16}$, is a terpene having, when purified, an odour coming between that of terpineol and terebene. It is prepared by re-distillation and fractionation of the residues left behind in the separation of piperitone (for synthetic thymol) from the oil of *Eucalyptus Dives*. In soap perfumery it has been found useful and is very cheap. S.G., 0.850; B.P., 58° C. at 12 mm.

Phenazone—*see* Antipyrine.

Phenetole is phenylethyl ether, $C_6H_5 \cdot O \cdot C_2H_5$, and is not much used in perfumery.

Phenyl Acetaldehyde Dimethyl Acetal, $C_6H_5 \cdot CH_2 \cdot CH(O \cdot CH_3)_2$, is a liquid having an intense odour of green leaf character. It is invaluable in lilac perfumes and certain types of roses and lilies. It is known as *Viridine*. Numerous other acetals of this aldehyde exist but are by no means as interesting. A typical example is phenylacetic aldehyde diethyl acetal, $C_6H_5 \cdot CH_2 \cdot CH(O \cdot C_2H_5)_2$, a liquid of softer odour than the parent body. S.G., 0.9619; B.P., 120° C. at 4 mm.

Phenylacetamide—*see* Acetanilide.

Phenylacetic Acid, $C_6H_5 \cdot CH_2 \cdot COOH$, is a crystalline compound melting about 76° C., and has been identified in oil of neroli. It has a peculiar honey-like odour which in extreme dilution recalls that of civet and has been recommended in place of this article. It may be prepared by treating benzyl cyanide with dilute sulphuric acid, and in small quantities is useful in the following floral oils—acacia, trèfle, neroli, and colourless jasmin. It is a first-class fixative, and owing to its solubility in water is useful for perfuming lotions and other toilet articles. It is the base of many honey compounds.

Phenylacetic Aldehyde, $C_6H_5 \cdot CH_2 \cdot CHO$, is a viscous and highly odorous liquid widely used as the base of hyacinth oils. It is prone to polymerise, but this may be

prevented to some extent by the addition of 5 per cent ethyl alcohol when freshly made. This aldehyde may be prepared synthetically in several ways, *e.g.* from cinnamic acid or from phenylacetic acid by reduction and is employed in compounding numerous flower oils. S.G., 1.05; B.P., 205° C. In addition to being the base of most hyacinths, it is useful in narcissus, sweet-pea, lilac, lily, and jonquille and is recommended in traces for preparing special types of rose perfumes (*which see*). On account of its intense floral odour it is used in small quantities in many compounds where price will not allow the inclusion of large proportions of natural absolutes. It is seldom used in soaps, being replaced by the more stable bromstyrole. An example of its use in a sweet-pea compound is appended:—

150	Phenylacetic aldehyde.
50	Benzophenone.
150	Terpineol.
350	Petitgrain oil.
20	Violet leaves—absolute.
80	Iso-butyl phenylacetate.
150	Heliotropin.
20	Musk ambrette.
30	Rose absolute.
<hr/>	
1000	

Phenylamyl Alcohol, $C_6H_5 \cdot (CH_2)_4 \cdot CH_2OH$, is a colourless oil having a fragrant lemon-verbena odour.

Phenyl Benzoate, $C_6H_5OOC \cdot C_6H_5$, is a crystalline substance melting at 68° to 70° C. It is a useful fixative. B.P., 314° C.

Phenylbutyl Alcohol, $C_6H_5 \cdot (CH_2)_3 \cdot CH_2OH$, is a colourless liquid of pleasant rosaceous fragrance.

Phenyl Cresyl Oxide, $C_6H_5 \cdot O \cdot C_7H_7$, is a liquid having a powerful odour recalling that of narcissus and rose. It is useful in the reproduction of this type of perfume for soaps and cosmetics. S.G., 1.060.

Phenylethyl Acetate, $C_6H_5 \cdot CH_2 \cdot CH_2OOC \cdot CH_3$, is a colourless, sweet-smelling liquid having an odour

reminiscent of green rose leaves, together with a suggestion of peach. It is an indispensable constituent of white rose compounds. S.G., 1.037 ; B.P., 232° C.

Phenylethyl Alcohol, $C_6H_5 \cdot CH_2 \cdot CH_2OH$, is a colourless liquid with a "honey-rose" odour recalling that of dried rose leaves, and is indispensable in compounding any type of artificial rose otto. It occurs naturally in the absolutes of rose and orange blossom and in the oils of neroli, champaca, geranium, and rose, but the greater portion disappears in the distillation of the latter, on account of its solubility in water. In view of this fact, attar of roses cannot be said to exactly represent the odour of the fresh flower, and yet the reproduction of a really fine artificial rose otto is impossible without the addition of about 10 per cent of the natural oil. Phenylethyl alcohol does not keep well, being partially oxidised to phenylacetic aldehyde ; it may be prepared by reducing phenylacetic esters with sodium in the presence of strong alcohol. The manufacture of this valuable organic body is at present in the hands of only three or four continental firms and one English firm. S.G., 1.024 ; B.P., 222° C. In addition to its extensive use in preparing synthetic rose, it is employed largely in orange blossom, neroli, and jasmin. It is also suitable as a base for any kind of sweet floral oil. Phenylethyl alcohol is extensively employed in the soap industry as a basis for rose compounds. These may be made on the following lines :—

200	Phenylethyl alcohol.
300	Bois de rose oil.
100	Geraniol—Java.
200	Geranium oil—Algerian.
50	Patchouli oil.
50	Civet extract, 10 per cent absolute.
40	Styrax.
60	Musk xylene.
<u>1000</u>	

Phenylethyl Anthranilate, $C_6H_5 \cdot CH_2 \cdot CH_2 \cdot OOC \cdot C_6H_4 \cdot NH_2$, is a white crystalline substance melting at

38° C. It possesses a sweet winey fragrance reminiscent of grapes and in this connection is of value. It blends well with methyl ionone and orris but its greatest importance to the perfumer is its usefulness in gardenia and broom compounds, giving to them a remarkably sweet persistence.

Phenylethyl Benzoate, $C_6H_5 \cdot CH_2 \cdot CH_2OOC \cdot C_6H_5$, is a liquid of soft rose-like odour. It is an excellent fixative in roses. S.G., 1.102.

Phenylethyl Butyrate, $C_6H_5 \cdot CH_2 \cdot CH_2OOC \cdot C_3H_7$, is a liquid having an odour of distinct rose type. It approximates more nearly to the natural odour than any of the other esters. It is also useful for improving the odour of phenylethyl alcohol. To compounds, traces will impart an inimitable fragrance. S.G., 1.001; B.P., 259° C.

Phenylethyl Cinnamate, $C_6H_5 \cdot CH_2 \cdot CH_2OOC \cdot CH : CH \cdot C_6H_5$, is a crystalline solid melting at 52° C. and having a pronounced balsamic odour reminiscent of purified Tolu balsam. It is very useful as a basis for a face powder perfume as follows :—

300	Phenylethyl cinnamate.
300	Amyl salicylate.
150	Ylang-ylang oil—Manila.
20	Oakmoss—colourless.
50	Vanilla absolute.
30	Civet extract, 10 per cent absolute.
50	Musk ketone.
100	Heliotropin.
<u>1000</u>	

Phenylethyl Dimethyl Carbinol, $C_6H_5 \cdot CH_2 \cdot CH_2 \cdot C(CH_3)_2 \cdot OH$, has a flowery odour and is useful in jasmims. S.G., 0.9712.

Phenylethyl Dimethyl Carbonyl Acetate, $C_6H_5 \cdot CH_2 \cdot CH_2 \cdot C(CH_3)_2 \cdot OOC \cdot CH_3$, has a fine rosy fragrance and may be used in such compositions. S.G., 0.989.

Phenylethyl Formate, $C_6H_5 \cdot CH_2 \cdot CH_2 \cdot OOC \cdot H$, is

a liquid with a fresh eglantine odour, and is useful in this and white rose compositions. S.G., 1.066; B.P., 221° C.

Phenyl Ethylene Acetate is a colourless mobile liquid of leafish fruity odour resembling peach or apricot. It may be employed in red rose and neroli type compounds.

Phenyl Ethylidene Acetone, $C_6H_5 \cdot CH_2 \cdot CH : CH \cdot CO \cdot CH_3$, is an oil which may be prepared by the condensation of phenylacetaldehyde and acetone. It has a specific gravity of 1.014 and boils at 108°—3 mm. This product has a remarkable odour of sweet-pea.

Phenylethyl Iso-butyrate, $C_6H_5 \cdot CH_2 \cdot CH_2OOC \cdot CH \cdot (CH_3)_2$, is a colourless limpid liquid with an odour of distinct rose type. It may be used with success in these compounds up to about 10 per cent. S.G., 0.996; B.P., 128° C. at 5 mm.

Phenylethyl Iso-thiocyanate, $C_6H_5 \cdot CH_2 \cdot CH_2N : C : S$, is a liquid having a peculiar pungent odour, and has been shown to occur naturally in the oils of mustard, mignonette, and nasturtium.

Phenylethyl Methylethyl Carbinol, $C_6H_5 \cdot CH_2 \cdot CH_2 \cdot C(CH_3)(C_2H_5) \cdot OH$, has a mild rose odour. S.G., 0.967.

Phenylethyl Phenylacetate, $C_6H_5 \cdot CH_2 \cdot CH_2 \cdot OOC \cdot CH_2 \cdot C_6H_5$, is a crystalline substance melting at 27° C., with a fine hyacinth-like odour, but much milder than phenylacetic aldehyde. It is useful in narcissus and jonquille perfumes, particularly the latter.

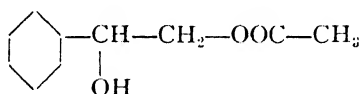
Phenylethyl Propionate, $C_6H_5 \cdot CH_2 \cdot CH_2 \cdot OOC \cdot C_2H_5$, is a colourless liquid having an odour which approximates more nearly to that of dried rose petals than any ester of this series. It is useful for modifying the odour of any sweet perfume. S.G., 1.019; B.P., 244° C.

Phenylethyl Salicylate, $C_6H_5 \cdot CH_2 \cdot CH_2OOC \cdot OH \cdot C_6H_4$, is a crystalline substance having a fine balsamic odour of the rose-hyacinth type. It makes an excellent base for bouquets.

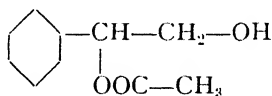
Phenylethyl Valerianate, $C_6H_5 \cdot CH_2 \cdot CH_2OOC \cdot C_4H_9$, is a liquid of fruity rose odour and is used as a tobacco flavour. S.G., 0.982; B.P., 265° C.

Phenylglycol, $C_6H_5 \cdot CHOH \cdot CH_2OH$, is a crystalline substance having a mild odour of lily-gardenia type and is useful in compounding these perfumes. It is known also as **Styrolyl Alcohol**. The confusion which exists in connection with the esters of this body and phenylmethyl carbinyl acetate, will perhaps be clarified by a reference to their constitution.

Phenylglycol Acetate, $C_6H_5 \cdot CHOH \cdot CH_2OOC \cdot CH_3$, is a liquid having an odour of gardenia-lily type. Known also as styrolyl acetate or gardeniol I, it is *primary* phenylglycol acetate having the constitution

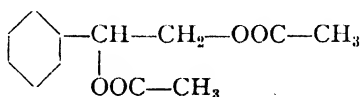


There is also a *secondary* phenylglycol acetate having an odour of jasmin type with the following chemical structure :—



Compare also the constitution of phenyl methyl carbinyl acetate or gardeniol II.

Phenylglycol Diacetate, $C_6H_5 \cdot CH(OOC \cdot CH_3) \cdot CH_2OOC \cdot CH_3$, is an oil having a fairly pronounced odour of gardenia, muguet, and hyacinths, in which compounds it may be used up to, but not exceeding 10 per cent. S.G., 1.147. This body has the following chemical structure :—



Phenylglycol Butyrate, $C_6H_5 \cdot CHOH \cdot CH_2OOC \cdot C_3H_7$, is a liquid of fruity hyacinth fragrance.

Phenylglycol Propionate, $C_6H_5 \cdot CHOH \cdot CH_2OOC \cdot C_2H_5$, is an oil of mild odour. It may be used in narcissus and jonquille type perfumes.

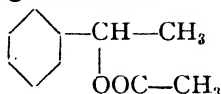
Phenylglycol Valerianate, $C_6H_5 \cdot CHOH \cdot CH_2OOC \cdot C_4H_9$, is a liquid having a fairly pronounced odour of fruity type associated with the fragrance of narcissus. It may be used in this type of compound.

Phenylheptyl Alcohol, $C_6H_5 \cdot C_6H_{12} \cdot CH_2OH$, is an oil having a pleasant rose odour. B.P., $171^\circ C.$ at 15 mm.

Phenylhexyl Alcohol, $C_6H_5 \cdot C_5H_{10} \cdot CH_2OH$, is a colourless liquid possessing an odour of roses and limes. B.P., $160^\circ C.$ at 13 mm.

Phenylmethyl Carbinol, $C_6H_5 \cdot CHOH \cdot CH_3$, is a liquid having a mild odour reminiscent of gardenia and hyacinth.

Phenylmethyl Carbinyl Acetate, $C_6H_5 \cdot CH(OOC \cdot CH_3) \cdot CH_3$, also known as gardeniol II, is a mobile liquid having a powerful odour of gardenia. It is not easily used owing to this characteristic, and requires to be well blended with the ionones and hydroxy citronellal if a really fine perfume is to result. S.G., 1.050; B.P., $214^\circ C.$ This body has the following constitution:—



and is sometimes erroneously referred to as styroyl acetate or styrolene acetate.

Phenyl Naphthyl Ketone, $C_6H_5 \cdot CO \cdot C_{10}H_7$, is a crystalline body having an odour of orange blossom type. It may be usefully employed in neroly, jasmin, and sweet pea compounds.

Phenylpropyl Acetate, $C_6H_5 \cdot CH_2 \cdot CH_2 \cdot CH_2OOC \cdot CH_3$, resembles the alcohol in some respects, but has

a sweeter odour recalling styrax and may be used in reseda, lilac, and muguet perfumes. It is a colourless liquid and probably occurs in cassia oil. S.G., 1.028; B.P., 244° C.

Phenylpropyl Alcohol, $C_6H_5 \cdot CH_2 \cdot CH_2 \cdot CH_2OH$, is a liquid possessing a sweet, mild hyacinth, reseda-like odour, and may be prepared by the reduction of cinnamic alcohol. It occurs naturally in styrax and white Peru balsam. It is useful as a basis for mignonette and will act as a substitute for reseda-geraniol. In conjunction with phenylethyl phenylacetate it is suitable for jonquille perfumes, and is recommended in the preparation of fancy bouquets of lilac-hyacinth type. This substance is known also as hydrocinnamic alcohol. S.G., 1.007; B.P., 235° C.

Phenylpropyl Aldehyde—*see* Hydrocinnamic Aldehyde.

Phenylpropyl Butyrate, $C_6H_5 \cdot (CH_2)_3OOC \cdot C_3H_7$, is a liquid having a fruity odour reminiscent of plums.

Phenylpropyl Cinnamate, $C_6H_5 \cdot CH_2 \cdot CH_2 \cdot CH_2OOC \cdot CH : CH \cdot C_6H_5$, has a powerful balsamic odour and occurs naturally in storax. It is a useful fixative and is employed similar to phenylethyl cinnamate.

Phenylpropyl Formate, $C_6H_5 \cdot (CH_2)_3OOC \cdot H$, is an oil of powerful sweet odour useful in the narcissus-hyacinth type of perfume.

Phenylpropyl Iso-butyrate, $C_6H_5 \cdot (CH_2)_3OOC \cdot CH \cdot (CH_3)_2$, has a milder and sweeter odour than the normal butyrate. S.G., 0.998; B.P., 125° C. at 3 mm.

Phenylpropyl Propionate, $C_6H_5 \cdot (CH_2)_3OOC \cdot C_2H_5$, is a liquid of heavy sweetness useful in the rose-hyacinth-narcissus type of perfume.

Phenylpropyl Valerianate, $C_6H_5 \cdot (CH_2)_3OOC \cdot C H_9$, is an oil having a strawberry note and is employed in the reproduction of the red rose odour.

Phenyl Salicylate—*see* Salol.

Phixia, 100 per cent, is a name given to hydroxycitronellal, of high boiling-point (*which see*).

Pigments.—The following list includes the more important colours used for tinting cosmetics and theatrical grease paints. For other shades reference should be made to dyestuffs :—

Black: *Animal Black* is obtained by carbonising all kinds of animal matter, including skin, horn, hoofs, etc.

Bone Black is supposed to be made from bones only.

Carbon Black is made by heating wood in closed retorts to a high temperature, the resulting mass being ground and washed.

Charcoal Black is carbon black.

Drop Black is prepared like Frankfurt black, but the ground product is mixed with glue water and sent into commerce in the form of tears.

Frankfurt Black is prepared by heating bones, vine twigs, etc., in closed retorts at high temperature, the resulting mass being pulverised and washed.

India Ink is probably lamp black moulded with glue or size and perfumed with musk, patchouli, etc. It may contain sepia.

Ivory Black prepared from ivory cuttings is a rare product owing to cost of raw materials.

Lamp Black is prepared from heavy oils by ignition and collection of the soot. It contains a high proportion of pure carbon.

Blue: *Antwerp Blue* is prepared by dissolving ferrous sulphate, zinc sulphate, and alum in water and adding a solution of potassium ferrocyanide.

Berlin Blue is a cheap form of Chinese blue.

Blue Verditer is a basic carbonate of copper.

Bremen Blue is obtained by mixing copper carbonate with an excess of copper hydroxide.

Brunswick Blue is made by adding barytes to Prussian blue.

Chinese Blue is the name given to the finest quality Prussian blue, and is prepared by adding potassium ferrocyanide to a ferric salt in solution.

Cobalt Blue is obtained by heating to redness the precipitated oxides of cobalt and aluminium.

Lime Blue is made by adding milk of lime to a solution of copper sulphate and ammonium chloride.

Paste Blue is Prussian blue.

Prussian Blue is ferric ferrocyanide. It is made in a similar way to Chinese blue.

Ultramarine is obtained when a finely ground mixture of kaolin, sodium carbonate, sulphur, and charcoal are heated to redness.

Brown : *Burnt Sienna* is anhydrous oxide of iron with traces of manganese, etc. The tint varies according to the temperature and period of heating.

Burnt Umber resembles sienna in manufacture.

Cappagh Brown is mined in the district of Cork, Ireland, and is a mixture of the oxides of iron and manganese.

Vandyke Brown is an impure hydrated oxide of iron.

Green : *Chrome Green* is a mixture of chrome yellow, barytes, and Prussian blue.

Cobalt Green is prepared by heating to redness the precipitated oxides of cobalt and zinc.

Emerald Green is aceto-arsenite of copper and should not be used.

Malachite is a basic carbonate of copper.

New Brunswick Green is chrome green.

Paris Green is emerald green.

Rinmann's Green is cobalt green.

Schweinfurth Green is emerald green.

Zinc Green is cobalt green.

Red : *Armenian Bole* is an impure ferric oxide.

Carmine Lake is a compound prepared from cochineal, lime, and alumina.

Chinese Red is prepared from lead chromate by warming with alkalis.

Chrome Red is similar to Chinese red.

Copper Chromate is brownish-red in colour.

Crimson Lakes contain a higher percentage of alumina than carmine lakes, together sometimes with additions of madder lake and alizarine lake or mixtures of all three.

Crocus is ferric hydroxide.

Derby Red is a name for Chinese red.

Indian Red is anhydrous oxide of iron (purplish).

Madder Lake is obtained when the colouring matter from the root of *rubia tinctorum*, the madder plant, is precipitated by inorganic bodies.

Red Oxide is Indian red.

Rouge is anhydrous oxide of iron, Fe_2O_3 .

Scarlet Lakes are crimson lakes tinted with vermillion. The name is sometimes given to various dyestuffs precipitated on organic bases.

Venetian Red is rouge of inferior quality (brick red) and sometimes mixed with calcium sulphate.

Vermilion is mercury sulphide. It occurs naturally as the mineral *cinnabar*, but is manufactured artificially from metal mercury and sulphur. Three shades are obtainable, extra pale, pale, and deep.

Violet shades are produced by mixing any of the blues and reds in suitable proportions; pale tints being obtained by the addition of zinc oxide.

White : *Zinc Oxide* is the best dead white; it is known as *Zinc White* and *Chinese White*.

Barium Sulphate is also used; it is known variously as *Permanent White* and *Barytes*.

Yellow and Orange : *Barium Chromate* is prepared from a soluble barium salt by the addition of potassium chromate.

Brilliant Yellow is a mixture of cadmium yellow and barytes or other basic white material.

Cadmium Yellow is cadmium sulphide.

Cassel Yellow is an oxychloride of lead.

Chrome Yellow is lead chromate.

Citron Yellow is zinc chromate.

King's Yellow is arsenic sulphide and *should not be used*.

Lemon Chrome is barium chromate.

Mineral Yellow is the same as Cassel yellow.

Montpelier Yellow is an oxychloride of lead.

Orange Chrome is a basic lead chromate.

Turner's Yellow is the same as Montpelier yellow.

Verona Yellow is cassel yellow.

Yellow Ultramarine is barium chromate.

Zinc Chrome is prepared by precipitation from solutions of its soluble salts with potassium chromate.

Pimento Oil is a fragrant yellowish-brown liquid whose odour resembles that of clove with a suggestion of cubebs and nutmeg, and for this reason is known as **Allspice Oil**. It is obtained by distillation from the dried unripe fruit of *Pimenta officinalis*, Lindley, N.O. Myrtaceæ, a plant native of the West Indies and found also in Central America. The pimento oil industry is centred in Jamaica where the trees present a unique appearance at the time the bark peels off, as the new bark underneath is a light cinnamon-brown colour. The berries are gathered in the unripe condition, and the bunches are broken from the branches of the tree when the first berry in the bunch has ripened. According to Wardleworth¹ if the branch is cut off with a knife it will die down for some considerable distance after the operation. The berries are carried to a barbecue and there allowed to dry in the sun. The yield of oil to distillation is about 4 per cent; it contains eugenol, methyl eugenol, caryophyllene, cineole, phellandrene, and palmitic acid and probably some terpene alcohols, the odour of the first-named constituent predominating. Pimento *leaf* oil

¹ "Year Book of Pharmacy" (1900), 423.

has recently claimed some attention, and there are now three stills working in Jamaica. The leaves from both "male" and "female" trees are distilled. Pimento oil is useful in bay rum, and is employed for modifying the odour of carnation oils. It is also used in the soap industry where it makes several pleasant compounds by the replacement of clove oil.

Pimpinella Anisum—*see* Aniseed Oil.

Pine Needle Oils are distilled from the needles and cones of several species of the N.O. Coniferae. A variety of interest to the perfumer is that obtained from the leaves of *Abies sibirica*, Ledeb., and known in the drug trade as Siberian "Pine" oil. This oil is distilled principally in North-East Russia and possesses a fragrant and refreshing odour of pine trees. A fine oil is now obtained from the Austrian Tyrol which is much appreciated by perfumers. Both are useful in preparing pine bath crystals and aromatic sprays for theatres and cinemas, etc. It contains a very high percentage of bornyl acetate (*which see*). Aldehyde C₁₂ is a constituent of the oil from *Abies pectinata*, D.C.

Piperonal is heliotropin.

Piperonyl Acetone—*see* Heliotropyl Acetone.

Pistacia—*see* Mastic.

Plasticisers are organic bodies added to solutions of nitro-cellulose to prevent the cracking of the film after the evaporation of the more volatile parts of the solvent. The subject is more fully dealt with in Volume II. under manicure preparations, where a list of plasticisers is given together with their boiling-points.

Plumiera—*see* Frangipanni.

P.N.S.C. (Parfum Naturel Sans Cire) is the highest concentration of natural flower perfume—*i.e.* Absolute (*which see*).

Point B—*see* Sting in Skin Preparations.

Pois de Senteur—*see* Sweet-Pea.

Pomades—*see* Enfleurage.

Portugal Oil—*see* Neroli and Sweet Orange.

Potassium Hydroxide, KOH, is prepared by the electrolytic decomposition of potassium chloride, and occurs in sticks or lumps containing about 80 to 85 per cent of real KOH. It is useful in the preparation of vanishing creams, and as a saponifying agent in the manufacture of liquid shampoos, etc.

Propyl Esters.—A complete range of these are now available, the only one of note being the phenylacetate, which is a useful constituent of jasmine perfumes. The others have a fruity bouquet.

Propyl Furoate, $C_4H_3O \cdot COOC_3H_7$, is an oily liquid having an odour reminiscent of amyl benzoate. It is useful as a fixative.

Pulegone is a ketone of the formula $C_{10}H_{16}O$, present in pennyroyal oil. It is used in dental preparations. S.G., 0.940; B.P., $224^{\circ}C$.

Putchuk—*see* Costus.

Pyrogallol Acid, or more strictly Pyrogallol, $C_6H_3(OH)_3$, occurs as a light, white, crystalline powder and is obtained by heating gallic acid. It melts at $131^{\circ}C$. and on exposure to the atmosphere soon assumes a dark colour. It is used in solution as a hair-dye, its action being assisted by such substances as copper sulphate, ammonium chlorhydrate, henna, etc.—*see* Hair Dyes, Volume II.

Pyrogallol—*see* Pyrogallol Acid.

Pyroxylin—*see* Nitro-cellulose.

pH Value is a number used to express the *active* acidity or alkalinity of any fluid substance. Pure water at $18^{\circ}C$. has a pH value of 7.07 but is usually given as 7.0. It is the adopted standard of absolute neutrality as the concentrations of the H and OH ions are exactly balanced. The

addition of any acid or alkali immediately upsets this balance, *acid* causing an increase in the H ions and a corresponding decrease in the OH ions, in consequence of which the *pH* value will become *less* than 7·07. *Alkali*, on the other hand, decreases the H ions and increases the OH ions ; the *pH* value of all alkaline solutions is therefore *greater* than 7·07. The various strengths are indicated by the respective distances from the standard neutrality figure of 7.

Universal Indicator for pH.—A two-solution method of determining the *pH* value of a liquid by means of a universal indicator has been devised. One solution is for determining the *pH* of acid solutions over a *pH* range from 1 to 7 while the other covers the alkaline range from *pH* 7 to 14.

The first solution consists of:—

Thymol blue	0·035 gram
Tropeolin OO	0·020 „
Bromphenol blue	0·010 „
Bromcresol green	0·030 „
Bromcresol blue	0·040 „
Alcohol 50 per cent	100 c.c.

This solution shows the following characteristic colours : *pH* 1, cinnabar red ; *pH* 2, orange-yellow ; *pH* 3, yellow ; *pH* 4, yellowish-green ; *pH* 5, green ; *pH* 6, greenish-blue ; *pH* 7, ultramarine.

The second indicator, for use with alkaline solutions, contains :—

Neutral red	0·035 gram
Thymol blue	0·015 „
Thymolphthalein	0·025 „
Nitamine	0·100 „
<i>m</i> -Nitrophenol	0·060 „
Alcohol 50 per cent	100 c.c.

Colours for this solution are *pH* 7, cinnabar red ; *pH* 8, yellow ; *pH* 9, yellowish-grey ; *pH* 10, greyish-green ; *pH* 11, greyish-blue ; *pH* 12, greyish-violet ; *pH* 13, brownish-violet.

Quandong is the name given in Australia to the tree which yields South Australian sandalwood oil—*Pusanus acuminatus*, R.Br., N.O. Santalaceæ.

Quantrovanil is a name given to ethyl protocatechuic aldehyde (*which see*).

Quassia is the wood of the trunk and branches of *Picræna excelsa*, Lindley, N.O. Simarubaceæ, grown in Jamaica. An aqueous extract is useful in hair lotions.

Quercitron—the name given to the bark of *Quercus tinctoria*, Olivier, or *Q. discolor*, N.O. Cupuliferæ, imported from America, and used for dyeing. **Quercitrin** is a glucoside.

Quillaia is the inner part of the bark of *Quillaja saponaria*, Molina, N.O. Rosaceæ, a tree grown in South America. It contains a body saponin (*which see*). The tincture (1 in 20 of 60 per cent alcohol) may be used in liquid dentrifices for producing a froth or foam, when soap is undesirable.

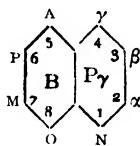
Quince—the seeds of *Pyrus cydonia*, L., N.O., Rosaceæ, cultivated in Europe. They contain about 20 per cent of a mucilaginous principle called **Cydonin**. On this account they are useful as a basis of creams where tragacanth is not desirable.

Quinine is the most important alkaloid present in cinchona bark, and is believed to be useful in hair tonics. **Eau de Quinine**, a bright red preparation, was originated by Ed. Pinaud, of Paris, and many have tried to imitate it. Quinine is also used in dentrifices.

Quinine Oleate is a thick brown liquid used in a 2 to 5 per cent solution in peanut or other vegetable oil as a preventive of sunburn.

Quinoline, C_9H_7N , is a colourless liquid, boiling at $236^\circ C.$ and having a powerful odour resembling pyridine, C_5H_5N . It was first obtained by distilling alkaloids such

as quinine and strychnine with caustic potash. It is now prepared synthetically by the Skraup process which consists of heating a mixture of aniline, glycerol, nitrobenzene and sulphuric acid, the quinoline distilling over and being subsequently purified by fractionation. There are a number of **Quinoline Derivatives** which are useful in perfumery, and these isomeric mono-derivatives have given rise to much confusion owing to their positions in the two nuclei. With a view to making this matter clear it should be stated that the Greek letters α , β , γ distinguish the three positions in the pyridine nucleus, while *ortho*, *meta*, *para*, and *ana* indicate the four positions in the benzene nucleus, as follows :—



The following eight quinoline derivatives are of practical importance in perfumery and are more completely described under their respective designations :—

Iso-butyl quinoline 2 and 6.

Iso-propyl quinoline 2 and 6 or lichenol.

2-Methyl quinoline or α -methyl quinaldine or quinaldine.

7-Methyl quinoline or lilacine.

p-Methyl quinoline.

Tetrahydro quinoline.

Tetrahydro-*p*-methyl quinoline or civettal.

Tetrahydro-2-methyl quinoline or tetrahydro quinaldine or hydroquinaldine.

Quino-Quino is the name given to a balsam resembling peru and tolu and obtained from *Myroxylon balsamum*, var. *punctatum*, Klotzsch, N.O. Leguminosæ, a tree growing in Florida, Bolivia, and Peru. It is used in the preparation of incense and as a varnish. Vanillin has been identified as

a constituent together with benzyl benzoate and benzyl cinnamate.

R. signifies resinodor, gomodor, etc. The preparation of this type of body is described in the chapter on fixation in Volume II. In the various formulæ it represents these products diluted with sufficient alcohol to make them pourable.

Radium has been alleged by some manufacturers to enter the composition of their cosmetic products. Radium bromide is of practical importance in medicine, but its extremely high price precludes its use in toilet preparations. Use therefore is made of radio-active materials such as Pitch Blende (Uraninite) and Thorium. They are mixed with talc, borax, and sodium perborate. Water is added and in paste form applied to the skin as "Radium Face Packs."

Randia is a genus of evergreen shrubs, natives of the East, and closely allied to the gardenia; there are several species, many of them very fragrant.¹

Raspberry Aldehyde, generally referred to as aldehyde C_{10} , is a mixture of organic bodies having a fine fruity odour.

Reine des prés—see Meadow-sweet and Salicyl Aldehyde.

Reseda—see Mignonette and the monograph in Volume II.

Resorcinol (*m*-dihydroxy benzene), $C_6H_4 \cdot (OH)_2$, is a crystalline substance melting at $116^\circ C.$, and boiling at $276^\circ C.$ It is a valuable antiseptic and is used with salicylic acid in the preparation of exfoliating cosmetics.

Reuniol is the name given to a mixture of geraniol and citronellol; it is used as a base for rose perfumes.

¹ For these see D. McDonald, "Fragrant Flowers and Leaves" (1895), 101.

Rhodinal, $C_{10}H_{18}O$, is an aldehyde isomeric with citronellal and is a white or yellowish-white liquid of characteristic (a little sharp) rose odour. It corresponds with the alcohol rhodinol and is used much in the same way. S.G., 0.875 to 0.880; B.P., 198° to 204° C.

Rhodinol, $C_{10}H_{19}OH$, was the name given to an impure compound isolated from rose otto by Eckart in 1891. It is used to-day by some manufacturers as a description for a mixture of geraniol and citronellol, while others claim that it is a pure alcohol isomeric with citronellol and separated from oil of rose geranium. It is prepared by British manufacturers by the fractionation of Bourbon geranium oil, the residual terpenes making an excellent substitute for geranium oil in cheap soap compounds. Commercial rhodinol, therefore, is probably a mixture of the two isomers rhodinol and citronellol. S.G., 0.875. The odour value of rhodinol differs with the source of supply, but the best and most expensive samples approximate more nearly to that of otto of rose than any other single perfume, excepting perhaps dimethyl octanol, B. It is suitable for all preparations of geranium and rose and is particularly useful in soaps. It is generally used in conjunction with phenylethyl alcohol and the esters of geraniol and citronellol. Rhodinol may be used effectively as a substitute for rose otto and absolute in many compounds, and particularly for those intended as perfumes for paraffin brilliantines. A rose compound for such a purpose which will not cloud may be prepared as follows :—

500	Rhodinol.
200	Citronellol.
100	Phenylethyl alcohol.
30	Geranyl formate.
150	Linalol.
20	Patchouli oil.
<u>1000</u>	

Rhodinyl Acetate, $C_{10}H_{19}OOC \cdot CH_3$, is a colourless oil with a fresh red rose odour. It is an indispensable constituent of all red rose perfumes. S.G., 0.890.

Rhodinyl Benzoate, $C_{10}H_{19}OOC \cdot C_6H_5$, is a liquid having an aromatic odour of rose type. It is a useful fixative in such compounds.

Rhodinyl Butyrate, $C_{10}H_{19}OOC \cdot C_3H_7$, is a liquid having a very much softer note than the geranyl ester, and is indispensable for the moss rose of subtle odour. S.G., 0.898.

Rhodinyl Formate, $C_{10}H_{19}OOC \cdot H$, has a powerful odour recalling red rose and is employed in perfumes of this type, intended for scenting all kinds of cosmetics. It is also useful in carnation compounds. It is a colourless liquid. S.G., 0.930.

Rhodinyl Iso-butyrate, $C_{10}H_{19}OOC \cdot CH \cdot (CH_3)_2$, is a liquid of fruity rose odour and finer than that of the normal-butyrate. S.G., 0.891.

Rhodinyl Phenylacetate, $C_{10}H_{19}OOC \cdot CH_2 \cdot C_6H_5$, is a yellowish-brown liquid having an odour which exactly duplicates that of rose de Mai. It is a valuable constituent of artificial roses.

Rhodinyl Propionate, $C_{10}H_{19}OOC \cdot C_2H_5$, is a colourless liquid having a sweet geranium-mint odour. It is used as a modifier for Oriental rose compounds. S.G., 0.908; B.P., 254° C.

Rhodinyl Valerianate, $C_{10}H_{19}OOC \cdot C_4H_9$, is a liquid of heavy rose odour. It is used as a modifier in such compounds and in Oriental perfumes. S.G.; 0.917.

Rhodium Oil—see Rosewood Oil.

Rhyuno Oil is distilled in Japan, and as it contains as much as 75 per cent of safrole, would appear to be of considerable commercial importance as a source for this product.

Rice Starch is obtained from *Oryza sativa*, L., N.O. Graminaceæ. The granules are extremely minute, nearly uniform in size, polygonal, and without evident hilum or striæ. It is the basis of many fine quality face powders,

“Poudres de Riz,” and is used in preference to other starches on account of its comparative invisibility. (The larger sizes of the granules of other starches give a “floury” effect.)

Rilan Wax—*see* Ceryl Cerotate.

Robinia Oil is obtained in the form of absolute by extracting the flowers of *Robinia pseudo-acacia*, L., N.O. Leguminosæ, with volatile solvents. It possesses an intense odour of the blossoms and contains indole, methyl anthranilate, linalol, benzyl alcohol, heliotropin, and terpineol, together with traces of aldehydes and ketones of a peach odour. Consult also the monograph on *Acacia* in Volume II.

Roccella—*see* Cudbear.

Rock Rose—*see* Labdanum.

Rondeletia—According to Sawer¹ this name was given by Plumier in memory of William Rondelet, a famous physician and natural historian, to an extensive West Indian and tropical American genus of the many-seeded division of *Cinchonaceæ*. Most of the species are shrubs, but a few grow to the size of trees, whose flowers are very fragrant. Perfumes sold under this name are not usually prepared from the natural flowers.

Rosacetol—*see* Trichlor Phenylmethyl Carbinyl Acetate.

Rose Absolute is obtained from the flowers of *Rosa Centifolia* and other species in the South of France and to some extent also in Bulgaria by means of volatile solvents and sometimes by extracting the pomade made by maceration. Its odour is quite different from that of the distilled otto and more accurately represents the fresh flower perfume. A rose oil obtained from German flowers by extraction with volatile solvents has been examined by Elze² who records

¹ “Odorographia,” second series (1894), 459.

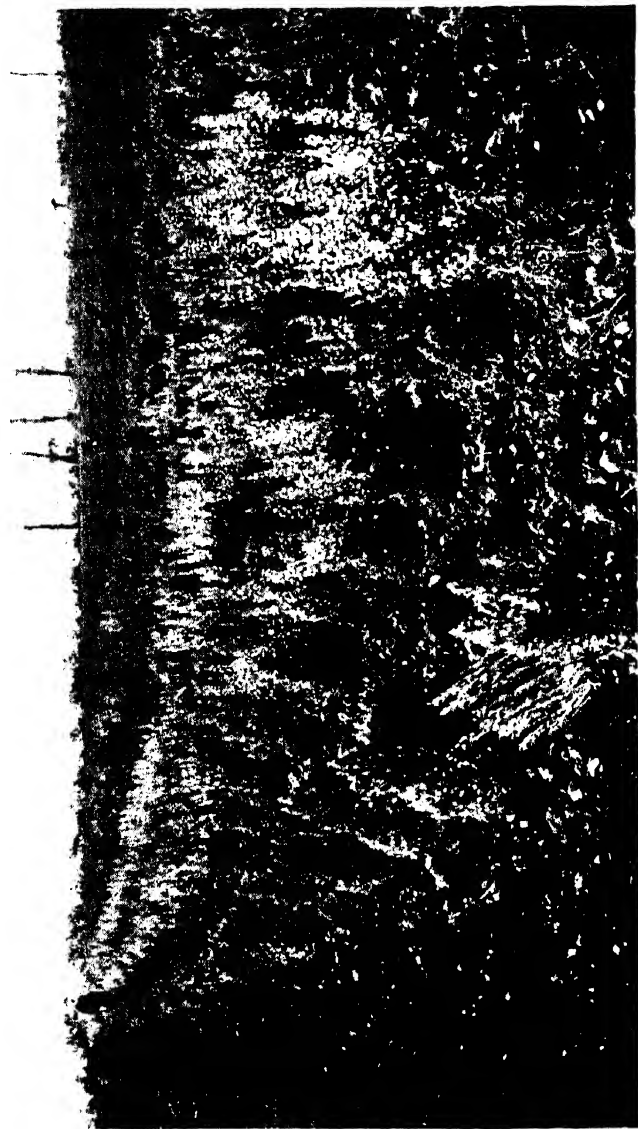
² “Year Book of Pharmacy” (1920), 73.



FIG. 40.—A field of Roses near Grasse.

[*Antoine Chiris.*

[*To face page 356.*



[*Stafford Allen & Sons, Ltd.*

FIG. 41.—Field of English Rosemary at Long Melford.

[*To face page 357.*

a yield of 0.015 per cent. He found that phenylethyl alcohol was the chief constituent, and in addition geraniol, citronellol, nerol, and farnesol were identified. For further details, reference should be made to the monograph in Volume II.

Rose de Grasse is the name sometimes given to rose absolute. It is also used as a description for the oil collected from rose water prepared on a large scale when it contains the more powerful aldehydic constituents and the whole of the stearoptene. Naturally the price is extremely high, but in spite of this, it finds a use in some of the really exclusive perfumes manufactured in England and France.

Rose de Mai is obtained in the South of France by extracting the flower with volatile solvents. It is the name given to rose absolute.

Rose-Geranium Oil is obtained by distilling French geranium oil over about fifty times its weight of fresh rose petals, the yield being only about 80 per cent of the original oil. It is the finest geranium oil obtainable and is prepared mainly at Grasse—see also Geranium Oils. Some commercial rose-geranium oils, of other than Grasse origin, are prepared by blending African and Bourbon oils, the former predominating in percentage.

Rosemary Oil is obtained by distillation of the flowering tops of *Rosmarinus officinalis*, L., and possibly other species of the N.O. Labiatae, plants indigenous to those parts of Europe bordering on the Mediterranean. The principal commercial oils are obtained from the South of France, Spain, and the Dalmatian Islands. In Spain the principal areas where the oil is distilled are Albacete, Castellon, Granada, Malaga, and Mercia. Here the plant is prolific in its growth and distillation is carried on all the year round, but mainly from April to October. Sometimes other plants of the N.O. Labiatae are distilled with rosemary, the principal species being *Salvia lavandulifolia*, Vahl. The stills are generally sunk in the ground

and heat is applied by direct fire, the bottom of the still having about 20 centimetres of water with a perforated plate above to support the herb. The plants are not always dried before distillation; the yield of oil is about 0.6 per cent. Each distillation takes three or four hours and the still is charged five or six times every twenty-four hours. In Dalmatia the plants are cut in June and when dry are thrashed, the leaves only being distilled. Rosemary is found growing on the mountain sides in Southern France and is occasionally cultivated. In the Alpes-Maritimes and the Eastern Pyrenees quantities of the oil are distilled, part by itinerant distillers and part in properly equipped factories. The entire plant with the exception of the woody stalk is distilled, and this is effected after the flowers have opened between June and September. The odour of the French oil is very fine and infinitely superior to the Spanish. Rosemary is distilled on a comparatively small scale in England, and this product is most esteemed; it is more expensive than the foreign oils. The character of these oils varies with the source and also with the parts of the plant distilled, the finest product being obtained from the dried leaves. The chief constituents of the oil are borneol, camphor, cineole, pinene, and camphene. Rosemary oil is liable to adulteration with turpentine, sage, and spike oils. It is used in cheap perfumery, hair washes, and soaps. English and French oils are employed for blending in eau-de-Cologne and give better results than other varieties. The terpeneless oil is four times concentrated. In soap perfumery rosemary oil will blend with lavender, spike, etc., to produce a cheap and refreshing odour. Such a compound may be made in the following lines:—

250	Rosemary oil.
250	Spike lavender oil.
50	Thyme oil.
350	Palmarosa oil.
50	Lemon-grass oil.
50	Coumarin.
<u>1000</u>	



[*Shipkoff & Co.*

FIG. 42.— Modern Fire Stills near Nova-Zagora.

[*To face page 358.*



FIG. 43.—Modern Stills at Kalofer.

[Shiphoj & Co.

[To face page 359.

Rosenöl is a synonym for rose otto.

Rose Oil, known also as otto or attar of roses, is distilled in Bulgaria from a red rose, *Rosa damascena*, and to some extent also from a white rose, *R. alba*, small shrubs cultivated in the valley of roses on the southern slopes of the Balkans. It is the common practice to distil both roses, although from an odour standard the white rose compares very unfavourably with the red one. The stills vary from the portable farmer type to the large modern apparatus heated by steam from a separate boiler. Large florentine flasks are used to collect the distillate. The otto floats on the top and is separated. This contains all the stearoptene and also the most highly odorous constituents. The rose water is redistilled (cohobated) and the oil which separates is mixed with that previously collected. The whole yields the rose otto of commerce. The principal constituent is *l*-citronellol which is present in good quality oils from 40 to 65 per cent. Other established constituents are geraniol, nerol, *l*-linalol, and their esters, eugenol, farnesol, citral, nonyl aldehyde, and stearoptenes. Phenyl-ethyl alcohol sometimes occurs in traces but owing to its solubility in water, is usually lost in the distillation waters. This alcohol is, however, present in the absolute prepared by the volatile solvent process, a certain quantity of which is produced in Bulgaria. (*Compare also* Rose Absolute.)

Other rose oils are met with in commerce, that from Anatolia being the only one of importance. It has an odour of similar type to that of the Bulgarian, but lacks something in bouquet and strength. In the South of France very little otto is produced and that generally is in fact a by-product in the preparation of rose water, which is not generally cohobated as in Bulgaria.

Attar of roses may be subjected to skilful and scientific adulteration, and among those bodies which may be employed for this purpose are : dimethyl octanol, B., rhodinol, geraniol, citronellol, etc. Artificial rose oils are now in common use and their price varies according to the amount

of genuine otto they contain. It is impossible at present to accurately reproduce the odour from synthetics and natural isolates alone. A comprehensive account of rose oil will be found in Volume II.

Rose Water—*see* Rose in Volume II.

Rosewood Oil is supposed to have been obtained by distillation from the wood of *Convolvulus scoparius*, L., N.O. Convolvulaceæ, a plant grown in the Canary Islands. It is commonly called oil of **Rhodium**, and has recently reappeared in commerce. In the drug trade oils bearing this description are frequently mixtures of geranium or palmarosa oil with sandalwood oil. The latter produces the viscosity characteristic of the true oil. The name is also given to bois de rose oil (*which see*). An imitation rhodium oil may be made thus :—

100	Rose otto.
300	French geranium oil.
600	Sandalwood oil—L.L.
<hr/> 1000	

Rouges Synthetic are dyestuffs (*which see*) ; they may be either carmoisine, eosine, erythrosine, rose Bengal, phloxine, or ponceau.

Rue Oil is obtained by distillation from different species of *Ruta* belonging to the N.O. Rutaceæ. In France the raw material is *R. graveolens*, L. In Algeria *R. montana*, L., yields the summer oil and *R. bracteosa*, L., the winter oil. The principal constituents of these oils are methyl-nonyl ketone and methyl-heptyl ketone. They account for about 90 per cent. Oils from *R. montana* are most highly appreciated in the synthetic perfumery industry, as the raw material for the preparation of methyl-*n*-nonylacetic aldehyde by means of the Darzen's glycidic reaction. Rue oil is used in sweet-pea compounds to which it gives a characteristic odour note.

Rusa Grass Oil—*see* Ginger-grass Oil.

Saffron, also known as crocus, is the dried stigmas and tops of the styles of *Crocus sativus*, L., N.O. Iridaceæ, grown in Southern Europe, South-West Asia, and India. It is cultivated principally in Spain. The chief constituent is crocin, a glucoside, easily soluble in water and producing a yellow solution. Saffron was at one time much used as a colouring agent, but owing to its high price is now largely replaced by the dyestuff, tartrazine yellow. **Saffron Oil** is a limpid liquid with a slightly yellow tint and possessing an intense odour of saffron, which, although exceedingly rich and of a somewhat culinary tone, is comparable to the fatty aldehydes. Its price is almost prohibitive, but only traces are required to produce original bouquets; and it is particularly applicable to the Oriental type of perfume.

Safrole, $\text{CH}_2 \cdot \text{O}_2 \cdot \text{C}_6\text{H}_3 \cdot \text{CH}_2 \cdot \text{CH} : \text{CH}_2$, occurs naturally in the oils of sassafras, star anise, nutmeg, ylang-ylang, cinnamon leaf, and camphor. At normal temperatures it is a colourless liquid with an agreeable odour; at lower temperatures it is a white crystalline solid and melts about 10° to 11° C. B.P., 233° C.; S.G., 1.105. It is obtained commercially by separation from camphor oil. Safrole is used as a cheap perfume and very largely in soap. It is used as the starting-point in the synthesis of heliotropin (*which see*). An illustration of its use in a soap compound is given:—

300	Safrole.
200	Bromstyrole.
150	Ginger-grass oil.
50	Lemon-grass oil.
200	Bois de rose oil.
70	Cassia oil.
30	Patchouli oil.
<u>1000</u>	

Sage Oil is distilled from *Salvia officinalis*, a shrub-like herb belonging to the N.O. Labiata, indigenous to the northern shores of the Mediterranean. It is a yellowish

liquid having a camphoraceous odour and is useful in soap perfumes. Commercial oils coming from Spain and Dalmatia are probably obtained from several species of which *S. triloba* is an important example. Sage oil is used as an adulterant for rosemary and spike lavender oils.

Salicylic Acid, $C_6H_4 \cdot OH \cdot COOH$, *o*-hydroxybenzoic acid, is a white crystalline body melting at 156° C. (some samples are greyish-white owing to impurities present). It is prepared by heating sodium phenate, under pressure, with carbon dioxide. Salicylic acid has remarkable preservative qualities, and on this account is valuable in certain toilet preparations. (*Compare also p*-Hydroxybenzoic Acid Esters.)

Salicylic Aldehyde, $C_6H_4 \cdot OH \cdot CHO$, is an aromatic liquid with an odour recalling that of meadow-sweet. It has been found in several essential oils, notably that distilled from *Spiræa ulmaria*, L., and other species of the N.O. Rosaceæ. It may be prepared artificially and is the starting-point in the synthesis of **Coumarin** (*which see*). Salicylaldehyde is employed in compounding violet and fancy bouquets, minute quantities only being used. S.G., 1.170; B.P., 197° C.

Salol or Phenyl Salicylate is a crystalline substance melting at 42° to 43° C. and having the formula $C_6H_4(OH) \cdot COOC_6H_5$. It has a mild odour of rose type and intensifies compounds used for perfuming oil in water creams.

Salvia Sclarea—*see* Clary Sage.

Sambucus—*see* Elder Flowers.

Sandalwood Oil, E.I., is obtained by distillation from the heartwood and roots of *Santalum album*, L., an ever-green tree belonging to the N.O. Santalaceæ and indigenous to the mountainous districts of Mysore (India) and to the

Dutch Indies. It grows in abundance at elevations up to 3000 feet above sea-level and attains a height of 30 to 40 feet. The tree is parasitic in its growth, the roots attaching themselves to the surrounding undergrowth and through them obtaining its nourishment, eventually causing their death. For the purpose of distillation, fully matured trees showing signs of natural death from old age are collected by the State Forest Department of the Government of Mysore. The soft wood and bark are removed and the trees are then sawed into billets, being sorted and classified as follows :—

- (a) Roots.
- (b) Billets.
- (c) Jajpokal.
- (d) Chieta.
- (e) Sawdust.

This classification is subject to further detailed subdivision, but in the main is based primarily on the oil content, and secondarily on its use as incense and for the artistic carving of idols, objects of art, etc. According to an English periodical¹ the trees are felled between the ages of 18 and 25 years. The felled trunks are left lying on the ground for several months so that they may be attacked by white ants. These insects consume the sapwood, leaving the heartwood, containing the oil, untouched. According to B. Sitaramachar² the major portion of the wood found its way before the Great War to German distillers, and up to 1916 the Mysore Government sold the entire output by public auction³ held in several depôts once every year. In 1915 to 1916 there were very few bidders at these auctions, and since this resulted in a reduction of revenue to the State, His Highness thought it desirable to start a factory of his own to distil the oil. In the month

¹ "Chemist and Druggist," 97 (1922), 385.

² "American Perfumer" (1924), 627.

³ These were resumed in the autumn of 1923.

of May, 1916, the first distillation took place in the factory located in Bangalore. This venture proved so successful that a much larger factory has since been built in the city of Mysore. Some years ago seeds were taken from this province and planted in Berar (Central Provinces). The trees are growing very well, and the wood does not exhibit any marked differences from that of the Mysore sandalwood, so that a satisfactory yield of oil is anticipated. Of late years, a form of blight known as "spike" is doing great havoc among the sandalwood groves in both Mysore and the surrounding districts. The nature of this disease and its causes are not yet clearly understood ; the matter, however, is discussed at length in an English periodical.¹

Of the total sandalwood production 75 per cent is produced in Mysore and district, while the greater part of the remaining 25 per cent comes from Timor, Celebes, and Sumba (Sandalwood Isle) in the Dutch East Indies. Macassar is the commercial centre, hence the name *Macassar wood*. Sandalwood oil having a high boiling-point requires rather a lengthy distillation process. In Mysore the yield varies between 4 and 6 per cent, while in the Dutch Indies it is from 3 to 5 per cent. This volatile oil is a rather viscid, pale yellowish liquid, having a peculiar, faint, but very persistent odour. It contains upwards of 90 per cent of **Santalol** which is, so far, regarded as a mixture of two alcohols. Small quantities of a very fine oil are still distilled in England. The usual adulterants of this product are castor oil and cedarwood oil.

Sandalwood oil plays a considerable rôle in medicine as well as in perfumery, and owing to its marked fixative properties, is one of the most important constituents of Eastern perfumes. It is also much employed in violet, cassie, rose and reseda compositions, and will blend well with heliotropin, coumarin, vetivert, and musk ambrette.

Sandalwood oil is also widely used in soap compounds,

¹ "P. and E.O.R." (1923), 57 ; (1924), 347.

both as an individual odour note and as a blender and fixer. A santal soap perfume is prepared thus :—

300	Sandalwood.
150	Cedarwood.
30	Petitgrain—Paraguay.
20	Mace or Nutmeg.
100	Geranium—African.
50	Orris oleo-resin.
70	Vetivert—Bourbon.
30	Patchouli—Singapore.
100	Benzyl acetate.
40	Ionone, 100 per cent.
60	Coumarin.
50	Musk xylene.
<u>1000</u>	

It should be noted that West Indian Sandalwood Oil is obtained from quite a different botanical source ; *Amyris balsamifera*, L., a tree belonging to the N.O. Burseraceæ.

Sandalwood Oil, W.A., is obtained by distillation from the wood of *Fusanus spicatus*, R.Br. (*Santalum Cygnorum*, Miq., *S. spicatum*, and *S. lanceolatum*) and possibly other species of the N.O. Santalaceæ. The trees are widely distributed in Western Australia, being found as far north as the Port Darwin district and as far south as Geraldton. Like the E.I. trees, they are of parasitic growth, feeding upon other plants which they attack below ground. The trees are felled by organised bands of wood-cutters controlled by the West Australian Forestry Commissioners. The branches, bark, and sapwood are removed and the logs transported overland to the coasts whence they are shipped to Perth. Here the wood is graded, and a significant point concerning it is that the closer its habitat to the equator the finer the quality of oil obtained. Large quantities of logs are exported to China, where they are made into Joss-sticks for consumption in their temples.

Sandalwood oil has been produced in Western Australia for some years, but prior to 1920 the sesquiterpene alcohol

content was seldom higher than 75 per cent, and in consequence the oil offered very little competition with the East India product. Since this date, however, the industry has been placed on a sound footing, and by a special selection of wood and careful distillation, an oil has been obtained having a sesquiterpene alcohol content of upwards of 90 per cent. Consult also the Forests Department Review.¹ The odour of this oil, however, differs slightly from that of the East Indian. It seems to lack the balsamic note of the latter. This does not, however, preclude its use in perfumery, where it will doubtless have a very wide application. In price it is about two-thirds that of the E.I., while in colour and viscosity there is no marked difference. The Western Australian oil is very useful in sandalwood soaps and may replace that indicated in the foregoing formula when a cheaper soap perfume is required.

Sandarac is a resinous substance obtained by incision from the stems of *Callitris quadrivalvis*, Ventenai, a tree belonging to the N.O. Coniferæ and indigenous to the mountainous districts of North-West Africa. The small, pale yellow tears have a slight terebinthinaceous odour and are soluble in alcohol and acetone. Sandarac is sometimes used as a constituent of nail varnishes.

Santalol, $C_{15}H_{24}O$, is a viscous colourless liquid having the soft sweet odour of santalwood. It is a useful constituent of artificial ambers. S.G., 0.980; B.P., 305° C.

Santalyl Esters. There is now a complete range of these. They are all useful in fine perfumery.

Saponin is a body occurring in quillaia bark, and is a mixture of two glucosides, *quillaic acid* and *quillaia-sapotoxin*. These are similar to the *polygalic acid* and *senegin* of senega root. Saponin is violently sternutatory, and will immediately produce a foam when shaken with water. It is very useful for emulsifying oils and fats, and on this account traces are employed in the preparation of so-called toilet

¹ "P. and E.O.R." (1929), 117.

milks. Its use in place of soap for making dental preparations foam is not recommended, as it leaves behind in the mouth a distinct bitterness.

Sassafras Oil is obtained by distillation of the root of *Sassafras officinale*, Nees., N.O. Lauraceæ, a tree attaining a height of about 40 feet and indigenous to North America. The inner root bark as well as the wood is used for distillation, and the yield of oil from the latter is about 2 per cent, while the former often contains as much as 8 per cent. Distillation was at one time carried out by the farmers with primitive apparatus but is now on a modern basis. The roots are collected and transported to the sawmills in pieces about 3 feet long. Here they are cut into thin shavings and transferred direct into the stills which are constructed of pine wood and secured by means of iron hoops. Steam is provided by an outside boiler, and after passing through the shavings is condensed in a worm cooled by water. The exhausted wood is used, after drying, as fuel for the boiler. This oil contains 80 per cent of **Safrole** together with eugenol, camphor, safrene, phellandrene, and pinene (*which see*), and is used as a cheap perfume for soap. Australian sassafras oil is distilled from the bark of *Atherosperma moschatum*, Lab., a plant belonging to the N.O. Monimiaceæ and native of Victoria.

Schiff Bases (so called) are condensation products of methyl anthranilate with aldehydes such as hydroxycitronellal, anisic aldehyde, cinnamic aldehyde, etc.

Schœnanthe is a synonym for oil of lemon-grass.

Sea Holly Oil is obtained by distillation from *Eryngium campestre*, L., a herb belonging to the N.O. Umbelliferæ. It is yellow in colour and possesses a musky fragrance.

Sepuddy—*see* Costus.

Serpolet Oil is distilled from a species of wild thyme (*which see*).

Sesame Oil, known also as gingelly oil or teel oil, is obtained by expression from the seeds of *Sesamum indicum*, L., a plant largely grown in India and other tropical countries and belonging to the family Pedalineæ. The yield is between 50 and 57 per cent and occurs in commerce as a limpid, pale-yellow liquid, having a pleasant, grain-like odour and bland taste. Sesame oil is a useful raw material in the production of oily cosmetics.

Sesquiterpeneless Oils—see Terpeneless Oil.

Sheih Oil—see *Artemisia* Oils.

Shikomol is the name given to a body which is identical with Saffrole.

Shiu Oil is distilled in Japan from a plant belonging to the N.O. Lauraceæ, and is offered as a substitute for linaloe oil. Two kinds of oil are exported, the one in its crude state and the other from which the camphor content has been separated. It contains from 50 to 65 per cent of linalol, linalyl acetate (?), eugenol, saffrole, cineole, pinene, camphene, dipentene, and formaldehyde. Commercially shiu oil is used as a source of linalol and its esters, the acetate making a cheap ester for the production of artificial bergamot oil. Shiu oil comes on the market as HO oil.

Siam Wood Oil—see Coffin-wood Oil.

Sighala Oil is a crude form of Storax.

$$\begin{array}{c} \text{CH}_3 \\ | \\ \text{C} \\ / \quad \backslash \\ \text{NH} \quad \text{CH} \end{array}$$

Skatole, C_6H_4 , is a crystalline substance

melting at 95°C . and boiling at 265°C ., possessing a most disagreeable odour, and has been identified as a constituent of civet. Like this body, its odour in dilute solutions is pleasant, and it is occasionally used instead of civet for fixing floral ottos. Skatole has also been identified in the woods of *Celtis reticulosa* and *C. Durandii*, Engl. (N.O. Urticaceæ),

and of different species of *Nectandra*. It is also produced when the sugar is extracted from molasses by the strontia method. Skatole is prepared synthetically from propylidene phenylhydrazide. Chemically it is related to Indole (*which see*), and is the β -methyl derivative.

Skouroupathos is the name given in Cyprus to the Cassie tree—*Acacia farnesiana*, Willd.

Snakewood Oil—*see* Canadian Snake Root Oil.

Soap Perfumes—*see* Volume II.

Sodium Alginate is a standard product manufactured in England from native algæ. It occurs as a greyish-white fibrous powder which produces standard mucilages under similar conditions at all times. These mucilages are transparent, water-white, and inodorous, thus differing materially from the physical appearance of the usual gum mucilages. The viscosity of sodium alginate mucilages can be controlled and standardised by the addition of calcium salts, such as the citrate, and by borax, etc. The thickening effect of the calcium ions on these solutions depends upon the precipitation of calcium alginate as a jelly. As with many other colloids, borax and glyceryl borate modify these physical characters. Other chemicals effect the solubility and viscosity of sodium alginate in water, particularly the alcohols. This property can be turned to advantage with glycerine or the glycols which yield stable products such as hand jellies, greaseless hair creams, toothpastes and hair-setting lotions. Sodium alginate is marketed under the name Manucol.

Sodium Carbonate Monohydrate, $\text{Na}_2\text{CO}_3 \cdot \text{H}_2\text{O}$, occurs as white crystals of various graded sizes, which find employment in bath crystals. Owing to its comparatively slow solubility, the smaller crystalline form is preferred.

Sodium Hexameta Phosphate, known commercially as calgon, is a white, highly hygroscopic powder composed in part of sodium metaphosphate, and a buffered mixture

of anhydrous phosphates. It finds application in aqueous solutions for preventing the precipitation of insoluble calcium salts and when incorporated in soap solutions and toilet soaps increases their lathering properties. One of its greatest commercial applications is in the laundry industry.

Sodium Hydroxide, NaOH , is obtained by the interaction of sodium carbonate and calcium hydroxide. It occurs in sticks, lumps, and powder and rapidly absorbs moisture on exposure. It is used in the preparation of vanishing creams. Sodium hydroxide should contain at least 98 per cent of actual NaOH .

Sodium Perborate, $\text{NaBO}_3 \cdot 4\text{H}_2\text{O}$, is obtained from borax by treating a saturated solution with an equal quantity of sodium hydroxide and about twice the amount of solution of hydrogen peroxide. The solution is kept cool when the sodium perborate crystallises out. It should contain about 85 per cent of available oxygen. Sodium perborate is used in dentifrices and also in the preparation of mud packs because it imparts a prickling or tingling sensation to the skin. The addition of 1 per cent to the usual bath salt ingredients will produce novel effects. The product stabilised with magnesium silicate should be used for this purpose. The alkali present in the bath salts will decompose the perborate with the evolution of nascent oxygen.

Sodium Sesquicarbonate, $\text{Na}_2\text{CO}_3 \cdot \text{NaHCO}_3 \cdot 2\text{H}_2\text{O}$, occurs as silky crystals or as a white powder, and when suitably coloured, makes a pleasing form of bath salts.

Sodium Sulphocarbolate, $\text{C}_6\text{H}_4(\text{OH})\text{SO}_2\text{ONa} \cdot 2\text{H}_2\text{O}$, is obtained from phenol and excess of sulphuric acid, the para-phenol sulphonic acid so produced being converted into the sodium salt. It occurs in colourless rhombic prisms and is sometimes used in skin and sunburn lotions.

Sodium Sulphoricinate is prepared from castor oil (3) by the action of sulphuric acid (1) in the cold. The

product of this reaction is washed and then nearly neutralised with sodium hydroxide. It is a colourless viscous liquid and is useful in conjunction with resinous tinctures for the preparation of toilet milks. From 3 to 8 per cent is the approximate proportion required, but the creams so produced are prone to separation on long standing.

Solvents in the technical sense have very little application in the perfumery industry, excepting perhaps in the preparation of nitro-cellulose nail enamels. Such products as acetone and amyl acetate are described in this volume, whereas a fairly complete list with boiling-points is given in the chapter on manicure preparations in Volume II—*see also* Plasticisers.

Son Sanate Balsam—*see* Balsamo Blanco.

Sorrel Tree—*see* Xolisma.

Souchet is a French name applied to the dried tuberous roots of several species of *Cyperus*, which on account of their aromatic properties are used as perfumes.

Sour Wood—*see* Xolisma.

Southernwood, commonly known as "old man," is a small shrub found in old cottage gardens. Botanically it is *Artemisia abrotanum* of the N.O. Compositæ, and its feathery foliage emits a peculiar fragrance much appreciated in bouquets made up by country people. It bears a small yellow flower.

Spearmint Oil is distilled from the fresh flowering spearmint, *Mentha viridis*, L., and other species of the N.O. Labiata, grown in England, America, Russia, Germany, etc. The largest quantities of oil are distilled in Michigan and Indiana, U.S.A., where the plant is known as green mint. According to the investigations of Rabak¹ the most fragrant

¹ Schimmel's "Report" (1919), 46.

oil is yielded by the fruiting plants and generally speaking is more agreeable when the herb is dried before distillation. The yield is about 20 lb. of oil per acre or about 2 per cent of the fresh plant. Spearmint oil consists principally of carvone (about 60 per cent), phellandrene, limonene, and either dihydrocarveol acetate or dihydrocuminic acetate. It is useful as a flavouring agent in dental preparations, and is largely employed in the manufacture of chewing-gum in the States.

Spermaceti—*see* Cetaceum.

Spicewood Oil is obtained from the bush *Laurus benzoin*, L., N.O. Lauraceæ, grown in North America, and known in Canada as "Spice Bush." It possesses a fragrant smell, and methyl salicylate has been identified as a constituent. It is also known as wild allspice, and is useful in bouquets containing lavender, where a spicy note is desired.

Spikenard Oil is distilled from the root of *Nardostachys jatamansi*, D.C., N.O. Valerianaceæ, a perennial herb, closely allied to the common valerian. It is a native of Nepal, Bhotan, and other parts of the Himalayan Mountains, and probably also of parts of Japan. In India its roots are highly prized as a perfume for the hair. The oil is pale yellow in colour, with an odour reminding of musk (faintly), patchouli, and valerian. It is practically unobtainable at present, and is sometimes replaced by the oil distilled from *Valeriana officinalis*, L., or by the valerianic acid esters of citronellol and rhodinol. A very complete and well-illustrated account of the different spikenards by A. Meunissier is contained in a French periodical.¹

Spike Oil—*see* under Lavender.

Spiræa Ulmaria is the meadow-sweet (*which see*).

Stannic Oxide, SnO_2 , occurs native or is obtained

¹ "La Parfumerie Moderne" (1922), 255.

when tin is burned in the air. It occurs as a heavy, yellowish-white powder and is the principal constituent of frictional nail polishes.

Starch—The three varieties of most interest to the manufacturer of cosmetics are the following :—

Maize starch from *Zea mays*, L., N.O. Graminaceæ.

Arrowroot from the rhizome of *Maranta arundinacea*, L., N.O. Marantaceæ.

Rice starch from *Oryza sativa*, L., N.O. Graminaceæ.

The first is largely employed as the base of violet powders, and dusting powders. The second, finely sifted and tinted, is sold as theatrical face powder. The third either alone or mixed with magnesium stearate, etc., is an indispensable constituent of the finest "Poudre des Riz." It should be noted that potato starch is not used in these products as the grains are so large and in consequence too visible to the eye.

Stavesacre Seeds are the dried ripe seeds of *Delphinium Staphisagria*, L., N.O. Ranunculaceæ, a stout erect herb attaining a height of about 4 feet and cultivated in Southern Europe and Asia Minor. In the form of a lotion or ointment they are useful for the destruction of pediculi.

Stearic Acid (saponified stearine), $\text{CH}_3(\text{CH}_2)_{16}\text{COOH}$, is obtained from tallow and other fats by saponification with lime or magnesia, in the presence of steam at high pressure, the stearate being subsequently treated with acid and purified. Several varieties are met with in commerce, and their melting-points vary according to purity (once pressed 126° to 127° F.; twice pressed 128° to 129° F.; triple pressed 130° to 131° F.). Stearic acid is the base used in preparing modern vanishing creams, and for this purpose should be a white crystalline inodorous solid, melting about 56° C. ("Distilled" stearine has a lower melting-point and should

be avoided.) The fatty acid is melted, and partially saponified by treatment with a hot alkaline solution. The cream is stirred until cold, and then suitably perfumed—*see* Skin Creams, in Volume II.

Stearyl and Palmityl Alcohols, $C_{18}H_{37}OH$ and $C_{16}H_{33}OH$, are now available under the trade name lanette wax, the proportions of each being present in about the same ratio as the corresponding fatty acids in commercial stearine. It is a useful material in the production of cosmetics because of its high absorbent properties for such substances as mucilages, oils, and waxes. Creams produced with it are characterised by an intense whiteness in appearance and good stability under changing temperatures. They are readily absorbed by the skin and leave no shine. Recently technical stearyl alcohol melting at 52° C. has made its appearance as a raw material in competition with cetyl alcohol. Whether its slightly lower price will induce manufacturers of cosmetics to abandon the well-tried and effective latter product remains to be seen.

Stephanotis, or creeping tuberose, as it is sometimes called, is *Stephanotis floribunda*, N.O. Asclepiadaceæ, a plant native to Madagascar. It is grown in greenhouses for its delightfully fragrant and beautiful white flowers, few equaling these in their wax-like purity. Stephanotis perfumes are usually mixtures of synthetics, with a liberal addition of natural tuberose. The following formula will show the lines on which this odour may be imitated :—

400	Rhodinyl acetate.
10	Iso-eugenol.
50	Coumarin.
200	Heliotropin.
40	Ionone alpha.
20	Orris oil, concrete.
20	Musk ambrette.
80	Cassie synthetic.
80	Jasmin synthetic.
100	Tuberose, absolute from concrete.
1000	

Stilbene, known also as symmetrical diphenyl ethylene, $C_6H_5 \cdot CH : CH \cdot C_6H_5$, is a colourless to yellowish crystalline substance melting at $125^\circ C.$ and soluble in hot alcohol. It is said to be an excellent constituent for anti-sunburn preparations owing to its properties of protecting the skin from the influence of ultra-violet light rays.

Sting in Skin Preparations has often troubled cosmetic manufacturers and caused them to think furiously. Seeing that the properties of almost all the commoner constituents are well known to chemists, the source of the irritation has generally to be looked for in the perfume. In the past perfumers have known that benzylidene acetone and hydroxy-citronellal, for instance, were to be avoided in compounds for scenting cosmetics, the knowledge having been arrived at by arbitrary methods. Owing to the clever foresight of Mr. Albert Albek of the Felton Chemical Company, this problem has been investigated and placed upon a much more scientific basis.¹

The intensity of skin irritation of the various aromatic bodies was measured by the point of dilution at which the burning sensation ceased. For purposes of brevity this was designated "Point B." In other words, Point B represents the point to which the various aromatics must be diluted to avoid the possibility of skin irritation. Certain of them possess a very high Point B and must be omitted from perfumes for toilet preparations. In making these tests, the part played by the human element received due consideration and the figures finally arrived at were obtained by applying the law of averages. It was found at the beginning that Point B depended upon both the physical and chemical properties of the various aromatics, such as chemical structure, viscosity, molecular weight, volatility, etc. It was next determined that the property having the greatest bearing on Point B was the actual chemical structure.

¹ "Aromatics" (September, 1931), 30.

The experiments were conducted thus : Five healthy, normal young women were selected as subjects. By using various concentrations of freshly distilled oil of turpentine in mineral oil (from 5 to 50 per cent) and allowing these solutions to act on the skin for various periods of time (averaging from 2 to 10 minutes), it was ascertained that the subjects experienced very similar "burning" sensations and were thus well matched for the purpose of the test.

In order to produce the burning sensation, a drop of the aromatic substance under test (or its solution in mineral oil) was gently rubbed on the inner part of the forearm of the subject, about an inch below the elbow. The skin on this part of the arm was found to be equally sensitive to that covering the cheekbone. The oil was allowed to remain on the skin from 2 to 10 minutes. Fresh turpentine oil and its solution in mineral oil were used as standards of comparison for the other aromatic bodies and the comparative action of the various aromatics undergoing test carefully recorded. Mr. Albek repeated each experiment 10 times, twice on each subject, and found the variations were generally insignificant. It then became necessary to standardise the burning sensation itself. This was accomplished by again using fresh turpentine oil. The five subjects were accordingly trained to remember a certain intensity of burn which was designated as "standard."

With a view to avoiding all possible error in the determination of Point B, the tests were conducted in two ways : the first was to record the time elapsing between the instant when the aromatic of a definite concentration was applied to the skin until the moment of "standard burn." The second method was to record the concentration of the aromatic which was required to produce the standard burn in a definite period of time. The average of these two results was taken to figure Point B for each aromatic substance.

As an example, Point B of iso-eugenol was calculated as follows : Turpentine oil was given the arbitrary Point B

of 10. Experiment showed by the first or "time" method that iso-eugenol produced the standard burn 3.2 times more quickly than turpentine. By the second or "concentration" method a solution one-third the strength of turpentine gave the same sensation in 5 minutes. Therefore Point B for iso-eugenol was calculated as $\frac{3 + 3.2}{2} \times 10 = 31$. In

non-technical terms, this means that iso-eugenol stings or burns the skin a little more than three times as much as oil of turpentine.

Although the figures covering Point B of various aromatics determined by the above method were only approximate, they were certainly sufficiently accurate to warrant some very definite conclusions.

The secondary alcohol group, CHOH , showed a tendency to increase Point B to a greater extent than the primary alcohol group, CH_2OH . The same relationship, however, existed between the aldehyde group — CHO and the ketone group $= \text{C} = \text{O}$. It was further shown that the increase in the number of double bonds between carbon atoms tends to increase Point B. There were numerous examples of the influence of chemical structure on the increase or decrease of Point B, a few of which are listed below.

Benzaldehyde, $\text{C}_6\text{H}_5 \cdot \text{CHO}$, has a much higher figure than acetophenone, $\text{C}_6\text{H}_5 \cdot \text{CO} \cdot \text{CH}_3$. Citral, an aldehyde with two double bonds, has a higher Point B than citronellal, an aldehyde of similar structure but possessing only one double bond. Decane, $\text{CH}_3 \cdot (\text{CH}_2)_8 \cdot \text{CH}_3$, a saturated aliphatic hydrocarbon, has a very low Point B. However, if a benzene ring is introduced and phenylbutane arrived at, $\text{C}_6\text{H}_5 \cdot (\text{CH}_2)_3 \cdot \text{CH}_3$, Point B is increased. If the structure of this body is then changed by introducing a carbonyl group and a double bond, benzylidene acetone results, $\text{C}_6\text{H}_5 \cdot \text{CH} : \text{CH} \cdot \text{CO} \cdot \text{CH}_3$, in which Point B is still further increased. Benzylidene acetone is, in fact, a much used aromatic chemical and possesses an exceptionally high Point B. This may be further attributed to the

fact that the carbonyl group and the double bond are in conjugate positions.

Examples of some of the commonly used aromatics determined by the above method are as follows:—

Turpentine oil	. . . . .	10
Phenylethyl propionate	. . . . .	3
Benzyl acetate	. . . . .	3.5
Linalyl acetate	. . . . .	4
Jasmin absolute	. . . . .	4
Geraniol	. . . . .	5
Bergamot oil	. . . . .	5
Terpineol	. . . . .	6
Methyl iso-eugenol	. . . . .	6
Anethol	. . . . .	6.5
Ionone	. . . . .	7
Orange oil	. . . . .	11
Acetophenone	. . . . .	13
Citronellal	. . . . .	16
Citral	. . . . .	22
Iso-eugenol	. . . . .	31
Benzaldehyde	. . . . .	36
Phenylacetic aldehyde	. . . . .	38

Considerable differences were often found in the Point B of chemicals in the same group ; for example, a wide variation existed between phenylacetic aldehyde and citronellal, but in spite of this, approximate averages were arrived at for various chemical groups as follows :—

Aldehydes	. . . . .	33
Phenols	. . . . .	26
Ketones	. . . . .	12
Terpenes	. . . . .	10
Phenolic ethers	. . . . .	8
Alcohols	. . . . .	5
Esters	. . . . .	4

The average perfume compound recommended for use in toilet preparations has a Point B of approximately 6, and it certainly should not be higher than 10.

If these latter principles are applied practically to a lilac

compound for perfumes and to similar ones for face creams, the following results are obtained :—

Lilac Perfume Compound.

250	Terpineol	}	$= 450 \text{ alcohols} \times 5$	$= 2250$
100	Phenylethyl alcohol			
100	Cinnamic alcohol			
60	Benzyl acetate	}	$= 80 \text{ esters} \times 4$	$= 320$
20	Jasmin absolute			
30	Iso-eugenol		$= 30 \text{ phenol} \times 26$	$= 780$
50	Anisic aldehyde	}	$= 440 \text{ aldehydes} \times 33$	$= 14520$
100	Heliotropin			
20	Amyl cinnamic aldehyde			
20	Phenylacetic aldehyde			
250	Hydroxy citronellal			
<u>1000</u>				<u>17870</u>

∴ Point B of 17·87

Lilac Face Cream Compound A.

300	Terpineol	}	$= 800 \text{ alcohols} \times 5$	$= 4000$
200	Phenylethyl alcohol			
200	Cinnamic alcohol			
100	Anisic alcohol			
100	Benzyl acetate		$= 100 \text{ esters} \times 4$	$= 400$
60	Methyl iso-eugenol		$= 60 \text{ phenolic ester} \times 8$	$= 480$
40	Heliotropin		$= 40 \text{ aldehyde} \times 33$	$= 1320$
<u>1000</u>				<u>6200</u>

∴ Point B = 6·20

Lilac Face Cream Compound B.

500	Terpineol	}	$= 700 \text{ alcohols} \times 5$	$= 3500$
200	Phenylethyl alcohol			
100	Benzyl acetate		$= 100 \text{ esters} \times 4$	$= 400$
50	Methyl iso-eugenol		$= 50 \text{ phenolic esters} \times 8$	$= 400$
10	Acetanisol		$= 10 \text{ ketones} \times 12$	$= 120$
40	Anisic aldehyde	}	$= 140 \text{ aldehydes} \times 33$	$= 4620$
100	Heliotropin			
<u>1000</u>				<u>9040</u>

∴ Point B = 9·04

In all these cases strength of dilution requires consideration, and while 1 per cent of Compound A should be quite safe, it would probably be advisable to use not more than 0.7 per cent of Compound B.

Stock—Night-scented stock is the delightfully odorous *Matthiola tristis*, N.O. Cruciferae. The perfume reminds somewhat of wallflower and mimosa and the natural oil is unknown. Good artificial compounds may be built up from the rose alcohols, heliotropin, orange flower synthetic, jasmin, anisic aldehyde, iso-eugenol, terpineol, and hydroxy citronellal. A base may be prepared as follows:—

250	Rhodinol.
100	Terpineol.
50	Linalol.
80	Hydroxy-citronellal.
50	Anisic aldehyde.
70	Cinnamic alcohol.
120	Alpha ionone.
10	Methyl salicylate.
50	Benzyl acetate.
20	Jasmin absolute.
150	Heliotropin.
20	Methyl naphthyl ketone.
20	Ylang ylang—Bourbon.
10	Coumarin.
<hr/> 1000	

Storax is a balsam obtained from *Liquidambar orientalis*, Mill, a tree belonging to the N.O. Hamamelaceae, and found growing in vast forests in the south-west of Asia Minor. The tree is plentiful along the Köprü river, north-east of Adalia in Pamphylia, and also in the marshy districts at the river mouths between Makri and Giova. It attains a height of 20 to 30 feet but when near a river may reach double this height. The balsam is stated to be collected chiefly by a tribe of Turcomans called Yuruks. In midsummer the outer bark of the tree is bruised and beaten which causes the balsam to exude into the inner bark. The outer bark is removed and subsequently sold for purposes of fumigation. The inner

bark is then stripped off by means of specially shaped knives and boiled with water which causes the balsam to separate and float to the top whence it is removed. The partially exhausted bark is then packed in horse-hair bags and subjected to pressure in a somewhat primitive wooden lever press. In order to facilitate the expression of as much balsam as possible, hot water is continually thrown over the bags. The balsams obtained by boiling and pressure are mixed in casks which are shipped at the more important ports in the Eastern Mediterranean. The exhausted bark is spread out in the sun to dry when it has the appearance of thin brownish-red strips. These retain a pleasant balsamic odour and enter commerce as *Cortex thymiamatis*. Another and slightly different account of the collection of storax is given by P. Jeancard in a well-known French paper.¹

In its crude state Oriental storax is a greyish-brown opaque balsamic resin and is purified for use by solution in alcohol, filtration and evaporation of the solvent. It soon assumes a transparent appearance. The odour of storax recalls naphthalin, but in very dilute solution it has a subtle bouquet reminiscent of hyacinth, jonquille, and tuberose. In the form of a 10 per cent tincture it is used as a fixative for handkerchief bouquets. The purified balsam has a wide application in soap perfumery, where it acts as an excellent all-round fixative and is much used in floral oils. It may be used with advantage in the following odours: hawthorn, hyacinth, jonquille, lavender, magnolia, night-scented stock, tuberose, and verbenia.

Storax contains about 1 per cent of volatile oil together with resin, etc. The essential oil is a yellowish-brown liquid having a pleasant odour. If fresh and properly prepared it should be devoid of any "gassy" character. It contains styrole, the ethyl, benzyl, cinnamyl, and phenyl propyl esters of cinnamic acid, phenyl propyl alcohol, cinnamyl alcohol, vanillin and probably naphthalin. Other

¹ "La Parfumerie Moderne," 18 (1925), 73.

storax balsams exist, and these are dealt with by the author together with their history in an American periodical.¹

Liquid Storax of American origin is found in slight excrescences on the bark of the tree *Liquidambar styraciflua*, L., occurring in vast forests high up in the mountains of Honduras. It is a viscous, transparent liquid having an aromatic balsamic odour, and was at one time exported to Spain from Mexico for perfumery purposes. This substance is sometimes known as white Peru balsam. *Compare also* Balsamo Blanco and Liquid Ambar.

Strawberry Aldehyde, or so called Hexadecyl Aldehyde C_{16} (*which see*), is a mixture in which methyl phenyl glycidate of ethyl predominates.

Styracin is Cinnamyl Cinnamate (*which see*).

Styrax—*see* Storax.

Styrole, $C_6H_5 \cdot CH : CH_2$, is a fragrant liquid, having an odour slightly recalling that of naphthalene. It may be prepared artificially, and has been identified as a constituent of several natural balsamic exudations, notably storax. It is a useful fixative for the hyacinth-type of perfume. Styrol is known also as styrolene and phenyl ethylene. S.G., 905; B.P., $144^\circ C$.

Styrolyl Alcohol—*see* Phenyl Glycol.

Styrolyl Esters—*see* Phenyl Glycol Esters.

Styrone is cinnamic alcohol (*which see*).

Suet is the internal fat of the abdomen of the sheep, *Ovis aries*, purified by melting and straining. It contains 70 per cent of stearin and palmatin, and about 30 per cent of olein. It is sometimes used as the fat base of cheap grease paints (*which see*).

Sulphites are used as a constituent of permanent

¹ "American Perfumer" (1924), 75.

waving solutions since they are readily oxidisable substances and protect the hair from damage which might be due to oxidation. Furthermore, sulphites act as a buffer in the retarding of the discoloration of white hair, which, in their absence, is apt to take on an unsightly yellowish tinge. In view of the fact that the sulphur dioxide content is responsible for the efficacy of these bodies, it is as well on formulating any product, to bear in mind the relative available SO_2 , which is as follows :—

Potassium metabisulphite . . .	58 per cent
Sodium sulphite anhydrous . . .	51 „
Ammonium sulphite monohydrate . . .	48 „
Potassium sulphite dihydrated . . .	33 „
Sodium sulphite crystals . . .	25 „

Sulphonated Lorol is a mixture of the sodium salts of the acid sulphates of (mainly) duodecyl alcohol, obtained by the hydrogenation of coco-nut oil or of its free fatty acids. It is a white flocculent powder, soluble in water and yielding a frothy solution similar to ordinary soap. It is neutral and does not precipitate the lime from hard water. These properties are taken advantage of for removing dirt, and particularly so in connection with the hair. Shampoos containing sulphonated lorol leave the hair in a soft silky condition and relatively little rinsing is necessary. It may be sold perfumed plus a filler or preferably with additions of soap powder and mild alkali. Liquid shampoos are not successfully made with the above product owing to its low solubility in cold water and the difficulty of preventing precipitation. When, however, the ammonia or triethanolamine salts are prepared instead of the sodium salt, a somewhat thick pale amber liquid results of slight but not unpleasant odour. The former only precipitates very slightly with cold water and the latter gives a bright clear solution. This in combination with infusions of henna or camomile makes attractive and effective liquid shampoos or bath fluids.

Sumbul Oil is obtained by distillation from the roots

of *Ferula sumbul*, Hooker filius, a plant belonging to the N.O. Umbelliferae and grown in India, Russia, and Turkestan. The root first entered Russian commerce about 1835 and was sold as a substitute for musk. Its botanical source, however, was not discovered until 1869 when Fedschenko found a specimen of the plant in the mountains of Maghian. The root is known as musk root on account of its slight musky fragrance which is developed in contact with water. Sumbul root as imported to-day, however, has an odour reminiscent of angelica and would appear therefore to be the product of another species, possibly *Ferula suaveolens*.¹ The oil obtained from the old root is a dark viscous liquid having the characteristic odour of the root. The yield is about 0.5 per cent. The composition of sumbul oil has been studied by Bauer² who found it to contain a mixture of cyclic and aliphatic hydrocarbons having nine carbon atoms, a sesquiterpene, sumbulene, a dextro-rotatory sesquiterpene like that found in W.I. santal, and a mixture of secondary and tertiary alcohols and an ester. Sumbul oil is difficult to obtain, but a strong tincture of the root, 1 in 5, in 90 per cent alcohol will replace it, and the resin (about 6 per cent) extracted will at the same time make an excellent fixative for Oriental bouquets.

Surea—see Elder-flower Oil.

Sweet-Pea is the popular name for *Lathyrus odoratus*, L., a plant belonging to the N.O. Leguminosae. It is a native of the Island of Sicily, and is now largely cultivated in our gardens for its elegant flowers of delicate and sweet fragrance. The odour of sweet-peas recalls that of orange blossom and hyacinth with just a suggestion of rose. There is also a typical green note which may be reproduced by either phenyl acetaldehyde dimethyl acetal or methyl heptene car-

¹ Consult the article by E. M. Holmes, "Pharm. Journal" (1925), 633.

² "Year Book of Pharmacy" (1922), 83.

bonate. Some perfumers even prefer methyl nonyl ketone for this purpose but it is not indispensable. Benzylidene acetone is also a recognised constituent of sweet-pea compounds, but owing to its acknowledged irritant properties it should be employed with discretion. Phenyl ethylidene acetone is perhaps preferable. Perfumes may be made with hyacinth and orange blossom compounds or actually based upon phenyl acetaldehyde. Musk ambrette blends excellently. The bouquet is improved by the inclusion of heliotropin, and may be fixed with tolu or mastic. Sweet-pea perfumes are dealt with in a separate monograph in Volume II.

Syringa.—The mock orange, *Philadelphus coronarius*, L., N.O. Saxifragaceæ, is commonly called "Syringa." This plant, however, has no right to the title as it is the botanical name for common lilac, *Syringa vulgare*, L., N.O. Oleaceæ. There are two other varieties worth mentioning, the one inodorous, and noted in Carolina in 1738, and the other, the large flowered "Gordon" syringa, introduced from California in 1838. The latter is the most strongly perfumed variety known. C. Farmiloe has prepared experimentally the concrete and absolute of syringa: 14 lb. 3 oz. of flowers gave 9.1 grams of concrete, 4.7 grams of concrete gave 2.5 grams of stearoptene and 1.88 grams of absolute. The odour approximated to that of jonquille and narcissus. More recently G. Igolen¹ has made several extractions in the laboratories of Antoine Chiris. From an olfactory point of view the best results were obtained with petroleum ether which gave a yield of 1.44 to 1.79 per cent of a brittle concrete essence red-brown in colour. Benzene gave 2.15 per cent of a green product of inferior odour. The yield of absolute from the former was 25 to 27.2 per cent of a thick red-brown liquid giving a whitish deposit. On dilution this absolute had a fine odour of the flower. It gave 9 per cent of essential oil of yellowish colour by distillate and cohobation. Mock orange perfumes are seldom

¹ "Les Parfums de France" (1938), 92.

obtained from the flower, but are more frequently mixtures of synthetic muguet and neroli, as the following formula will illustrate :—

250	Terpineol.
150	Linalol.
200	Hydroxy-citronellal.
10	Iso-butyl benzoate.
30	Methyl anthranilate.
50	Benzyl acetate.
100	Linalyl acetate.
150	Phenylethyl alcohol.
10	Vanillin.
5	Indole, 10 per cent.
5	Decyl aldehyde, 10 per cent.
40	Methyl phenyl acetaldehyde.
<u>1000</u>	

Syringa Aldehyde—*see* Methyl Phenyl Acetaldehyde.

Taget Oil (marigold) has recently been distilled on an experimental scale by one of the large manufacturers in the South of France. The plant would appear to be a variety of *Tagetes*, N.O. Compositæ, possibly either *T. glandulifera*, Schrank or *T. patula*, L. The oil was of a reddish-yellow colour and possessed an intense cloying fruity odour which suggested its use in perfumes of the heavy type. In extreme dilution the odour resembles that of apples. Experiments showed that compounds containing one or two parts of the oil per thousand soon developed the taget odour note, and this was distinctly evident when the compound was used to perfume a face powder. The results indicated the use of the oil, about 1 in 10,000, as a possible blender for perfumes of gardenia type. Marigold oils have been described elsewhere by H. S. Redgrove.¹

Talc is a hydrated silicate of magnesium with a soapy feel. It has the theoretical formula $H_2Mg_3Si_4O_{12}$. The finest qualities (usually Italian) are white in colour, while inferior grades are greyish. The best samples should have a "slip" comparable with powdered boric acid,

¹ "Manufacturing Perfumer" (1937), 254.

but not a too lustrous appearance since this is generally indicative of insufficient grinding. The final test of a good talc is its behaviour towards hydrochloric acid. The matter soluble in this acid should not exceed 4 per cent. These qualities are necessary if the talc is to act as a perfect lubricant and preventive of irritation, furthermore an excess of acid soluble matter will quickly spoil most perfumes and often cause discoloration. In powder form talc is largely used in toilet powders, and is sold with or without admixture, but well perfumed, as *Talcum Powder* (*which see*).

Recently *micronised* talc has made its appearance under patent specification. The makers give two reasons why it may be advantageously used in cosmetics: (1) during the micronisation process the talc is heated to 600° F., and is therefore automatically sterilised; (2) the even distribution of particle sizes give better and more even covering power. Micronised talc has about three times the bulk of the mother substance.

Tangerine Oil is known in commerce as mandarin oil (*which see*).

Tangerine Petitgrain Oil—*see* Petitgrain Mandarin Oil.

Tansy Oil is obtained by the distillation of the leaves and tops of *Tanacetum vulgare*, L., N.O. Compositæ, a herb found in the United States and Europe. The yield is about 0.2 per cent, and when fresh is yellow turning to brown with age and exposure. Thujone is the principal constituent together with some camphor. Its principal use is in medicine, but small quantities are used from time to time in toilet waters.

Tarragon Oil is obtained by distillation from *Artemisia dracunculus*, L., N.O. Compositæ, and is generally considered to be of culinary value only, the entire plant being used for this purpose and the yield about 0.5 per cent. The oil is yellowish-green in colour, and has a persistent and powerfully aromatic odour reminding of anise. It contains

methyl chavicol, phellandrene, an aliphatic hydrocarbon resembling ocimene, and probably also *p*-methoxy-cinnamic aldehyde. This oil is also known as *estragon*. In perfumery, however, it may be used up to 1.5 per cent for obtaining special effects in fancy bouquets, Colognes, chypres, ferns, and new-mown hay types.

Tea Absolute is obtained by extraction with volatile solvents from the tea leaf furnished by *Thea chinensis*, Sims, a shrub native to China, but now cultivated in India, and belonging to the N.O. *Termstreмиaceæ*. It is a dark coloured semi-fluid substance but may also be obtained in the colourless form at a much enhanced price. To distillation, the leaves yield 0.006 per cent of essential oil after fermentation. Analysis showed the principal constituents to be methyl salicylate and phenylethyl alcohol, together with iso-valeryl aldehyde, citronellol, hexanal, and iso-butyl aldehyde. The absolute has a warm amber odour reminiscent of tobacco. It may be used in perfumes of the type Leather, chypre, fougere, and hay.

Tea Roses—see the monograph in Volume II.

Tea Tree Oil¹ is obtained by the distillation of the leaves of *Melaleuca alternifolia*, trees of the N.O. *Myrtaceæ* growing in Australia. The yield is nearly 2 per cent. It is comparatively new although a party of Germans were distilling the oil before the war. In 1926 a sample was examined by Mr. A. R. Penfold who found it to have a high germicidal value—about 11 to 13 times that of phenol, although it is non-poisonous and non-irritant. Through the courtesy of Mr. W. J. Anderson of Sydney the author received a sample of this product which is a water-white limpid liquid having a pungent odour reminiscent of nutmeg or mace. It would appear to have no application in fine perfumery but when blended with lavender, bergamot,

¹This popular name arose from the story of Captain Cook's sailors having used the leaves of a species of *Laportospermum* as a substitute for tea. Compare also "P. and E.O.R." (1934), 374.

etc., should make an excellent cinema spray. It is used in medicated soaps and dentifrices and would make an excellent perfume for deodorants owing to its high germicidal value and complete absence of toxicity and irritation. In solution it is stated to have remarkable contraceptive properties. The principal constituents so far isolated are pinene, terpinene, cymene, terpineol, and cineole 8 per cent. **Lemon Scented Tea Tree Oil** is distilled from the leaves and twigs of *Laportea citratus*, a tree of the N.O. Myrtaceæ, now well established in New South Wales and Queensland. The yield is from 1.5 to 2 per cent. It is a bright yellow oil having a strong lemon type odour and is not dissimilar from a mixture of lemon-grass and Java citronella. It contains citral as the principal constituent and may prove useful as a soap perfume.

Teel Oil—see Sesame Oil.

Terebene is a colourless and odorous liquid made by treating oil of turpentine with sulphuric acid, and is used in medicated soaps.

Terpeneless Oils possess many advantages over the ordinary essential oils of commerce, and as a group are one of our most useful perfume raw materials. They are the result of researches made during recent years into the constitution of volatile oils, and have led, in many cases, to the proper evaluation of the several constituents and to the manufacture of concentrated oils described as “terpeneless,” “sesqui-terpeneless,” etc.

The removal of the non-oxygenated constituents consisting of hydrocarbons, terpenes, and resins, etc., is generally effected by fractional distillation *in vacuo*, and if this process is carefully controlled, the odour of the resulting concentrated oil is not impaired. Unfortunately, however, there is an enormous difference in the makes of terpeneless oils—bergamot, for example, and although it is possible that the raw material may have something to do with this, it is feared that in the majority of cases the imperfections are

due to careless manipulation during manufacture. The terpene residues, which are considerable from *Citrus oils*, are cheap, and while some find their way into the soap industry, a large proportion is probably used for the adulteration of natural oils. Any of the disadvantages in the usual process referred to above are overcome by the method suggested by Dýck and Ruy's,¹ in which the normal oil is brought into contact with two solvents led in counter current, and which solvents are only partially soluble in each other. These chemists used pentane as the solvent for the terpenes and diluted methyl alcohol as solvent for the oxygenated constituents. Remarkably fine products are said to result from this process which is being patented.

A good terpeneless oil consists of the odoriferous ingredients only, and in the case of lime oil, for example, this would not only include the citral, but all those other traces of unknown constituents which contribute so largely to the characteristic odour of the natural oil. Terpeneless oils, therefore, should not be confused with synthetics or even natural isolates, for who would say that citral from *Lemon-grass oil* possesses so delicate and sweet an odour as terpeneless limetta oil, or that geraniol from *Palmarosa oil* is so fragrant as concentrated geranium oil, which not only contains geraniol but also citronellol with both their esters? This confusion has probably arisen through the comparison of such examples as anethol with terpeneless aniseed oil, and linalol with terpeneless bois de rose oil, but these instances are rare. Terpeneless oils always have more "body" than synthetics, and their preferential use is strongly recommended. To illustrate this point, better results are obtained from the employment of virgin rose otto mixed with terpeneless French geranium oil than from the same otto diluted with geraniol.

Furthermore, terpeneless oils possess two distinct advantages over the original oil in that they are (a) much more soluble in *dilute* alcohol, and (b) do not so readily decompose with age.

¹ "P. and E.O.R." (1937), 91.

The first is really of most importance owing to the great popularity of lotions made with weak alcohol. The natural oil, when added to dilute alcohol, always becomes turbid, due to the precipitation of the insoluble terpenes, and while the clarification of such a solution takes time, there is also a loss due to evaporation of the solvent. By experiment and after reference to the appended table of concentrations, it will be easy to arrive at the exact amount of terpeneless oil that can be used to replace the usual quantity of the natural one. The final product will not then require to be filtered, and in all probability a still further dilution of the alcohol will be possible with a proportionate saving. Several examples illustrating this advantage will be found under the chapter on Toilet Waters in Volume II.

Different manufacturers give varying concentrations for their oils, and the following list has been compiled after due consideration of the maximum and minimum figures given (see pp. 392, 393).

Terpineol, $C_{10}H_{17}OH$, occurs naturally in several essential oils, including those of linaloe, geranium, bergamot, magnolia, gardenia, petitgrain, and neroli. It is prepared artificially on a large scale and may be obtained from turpentine. This is first converted into terpin hydrate, which after recrystallisation from strong alcohol is boiled with dilute mineral acid. S.G., 0.940; B.P., 218° C. Commercial samples probably consist of alpha-terpineol together with other isomers. This alcohol is much used in perfumery as the basis of the lilac type of perfume, while owing to its extraordinary stability it is largely employed in the soap industry. It blends well with almost any synthetic and particularly with hydroxy-citronellal, linalol, and ylang-ylang oil.

By far the largest proportion of terpineol enters the soap industry, and many are the tablets of toilet soap which do not contain any other perfume than this alcohol. The art in its use lies in being able to employ it as a base on which to build fanciful odours. It blends well with almost any essential oil or synthetic.

Table of Terpeneless Oils.

Showing their Solubility in Alcohol and Comparative Strength with the Natural Oil.

	Approximate Concentration.	Solubility in Alcohol.
Angelica	20	1 in 1—80 per cent.
Anise	1½-2	1 in 1—90 „
Aspic	2	.....
Backhousia	2	.....
Basil	2½	.....
Bay	1½-3	1 in 2—70 „
Bergamot	3	1 in 1—80 „
Bois de Rose	2	.....
Calamus	8	.....
Camomile	2	1 in 2—80 „
Cananga	3-5	1 in 1—95 „
Canella	2	1 in 2—70 „
Caraway	2-2½	„ „ „
Cardamons	2	1 in 3—70 „
Cassia	2	1 in 2—70 „
Cedrat	30	.....
Celery	8-10	1 in 1—80 „
Cinnamon Bark	2	1 in 2—70 „
„ Leaf	2	1 in 1—70 „
Citronella (Ceylon)	2	„ „ „
„ (Java)	2-2½	„ „ „
Cloves	1½	„ „ „
Coriander	3-4	1 in 3—65 „
Cubeb	2	.....
Cummin	4	1 in 3—75 „
Curcuma	2	.....
Cypress	20	.....
Dill	2-2½	1 in 2—70 „
Eucalyptus	4	„ „ „
Fennel	2	1 in 3—85 „
Galangal	3	.....
Geranium	1½-2	1 in 2—70 „
Ginger	8-10	1 in 1—90 „
Ginger-grass	2	.....
Hops	8	.....
Hyssop	2	.....
Juniper Berries	10	1 in 1—90 „
Laurel	4	1 in 3—65 „
Lavender	2-2½	1 in 2—70 „

	Approximate Concentration.	Solubility in Alcohol.
Lemon	16-20	1 in 1—80 per cent.
Lemon-grass . .	2	1 in 2—70 „
Limes	15	1 in 2—80 „
Linaloe (Mexican) .	2	.....
Mace	4	.....
Mandarin	50-70	1 in 1—90 „
Marjoram (Sweet) .	2	.....
Melissa	5	.....
Myrtle	2	.....
Neroli	2-3	1 in 2—70 „
Nutmeg	6-8	1 in 2—80 „
Orange	40	1 in 1—80 „
Origanum	3	.....
Palmarosa	1½-2	1 in 2—70 „
Parsley	10	1 in 2—80 „
Patchouli	2-4	1 in 1—95 „
Peppermint	2	1 in 3—70 „
Petitgrain	2	1 in 1—80 „
Pimento	2	1 in 1—70 „
Pine	3	1 in 2—75 „
Rosemary	3-4	1 in 2—75 „
Rose (Stearopteneless)	1½	1 in 1—70 „
Rue	2	.....
Sage	3-6	1 in 2—75 „
Salvia Sclarea . .	2	.....
Santal	2	.....
Sassafras	2	1 in 2—75 „
Spearmint	3-4	1 in 2—75 „
Tansy	2	.....
Thyme (Algerian) .	2	.....
„ (French)	3-5	1 in 1—70 „
Verbena	2	.....
Vetivert	3	.....
Wormwood	3	.....
Ylang-Ylang . . .	4	.....

Terpinyl Acetate, $C_{10}H_{17}OOC \cdot CH_3$, is a colourless liquid having an odour not unlike a mixture of bergamot and lavender. It occurs naturally in Cypress and Melaleuca oils, but may be prepared artificially by heating together terpineol and acetic anhydride. It is used as

an adulterant for lavender oil but mainly as a modifier in soap perfumery, lavender being a typical example. S.G., 0.965; B.P., 220° C.

Terpinyl Anthranilate, $\text{NH}_2 \cdot \text{C}_6\text{H}_4 \cdot \text{COOC}_{10}\text{H}_{17}$, is an ester obtained from anthranilic acid and terpineol. It is a liquid having an odour approximating closely that of lily of the valley and orange blossom.

Terpinyl Butyrate, $\text{C}_{10}\text{H}_{17}\text{OOC} \cdot \text{C}_3\text{H}_7$, has been found in the oil of mountain pine (N.S. Wales). It may be prepared synthetically and is a liquid of characteristic odour. It is useful in fancy bouquets.

Terpinyl Cinnamate, $\text{C}_{10}\text{H}_{17}\text{OOC} \cdot \text{CH} : \text{CH} \cdot \text{C}_6\text{H}_5$, is a liquid with a fragrant and persistent odour. It is useful in the preparation of new-mown hay, and also in combination with rose and bergamot as the basis of "ideal" perfumes.

Terpinyl Formate, $\text{C}_{10}\text{H}_{17}\text{OOC} \cdot \text{H}$, is a liquid with a pleasant, rather fresh smell resembling citronellyl formate. It may be synthetically prepared, and is useful in the compounding of pseudo-nerolis. It has been found in Ceylon cardamon oil. S.G., 0.990.

Terpinyl Iso-butyrate, $\text{C}_{10}\text{H}_{17}\text{OOC} \cdot \text{CH} \cdot (\text{CH}_3)_2$, is a liquid having similar properties to the normal butyrate. It is useful in combination with acetanisol in fougere soaps.

Terpinyl Propionate, $\text{C}_{10}\text{H}_{17}\text{OOC} \cdot \text{C}_2\text{H}_5$, is a liquid whose odour approximates more nearly to that of French lavender than any of the other esters. With an equal volume of bergamot oil it is invaluable for the perfuming of cheap lavender bath crystals—especially if fixed with oleo-resin orris.

Terpinyl Valerianate, $\text{C}_{10}\text{H}_{17}\text{OOC} \cdot \text{C}_4\text{H}_9$, occurs naturally in oil of Cypress. It is a colourless liquid and

may be prepared synthetically. It is useful for blending in tobacco flavours as follows :—

200	Terpinyl valerianate.
200	Geranium oil.
200	Cassia oil.
200	Clove oil.
20	Vanillin.
180	Coumarin.
<u>1000</u>	

Tesu is an Indian dyestuff consisting of the dried flowers of *Butea frondosa*, Roxb., a plant belonging to the N.O. Leguminosæ and grown in the East. An acid decoction will dye materials a brilliant yellow which is turned to reddish-orange by traces of alkali in excess.

Tetradecyl Aldehyde—see Undecalactone and also Myristic Aldehyde.

Tetrahydro Geraniol—see Dimethyl Octanol.

Tetrahydro Linalol is a liquid having a fine lily odour and infinitely superior to that of linalol for fine perfumes.

Tetrahydro 2-Methyl Quinoline, $\text{CH}_3 \cdot \text{C}_9\text{H}_9 \cdot \text{NH}$, is a chemical body having an odour of lilac type. It is known also as *Tetrahydro Quinaldine* and **Hydroquinaldine**.

Tetrahydroparamethyl Quinoline, $\text{CH}_3 \cdot \text{C}_9\text{H}_9 \cdot \text{NH}$, is a yellowish crystalline substance melting at 34° to 36° C. and having a powerful odour of the civet type. It is known as *Civettal*.

Tetrahydro Quinoline, $\text{C}_9\text{H}_{10} \cdot \text{NH}$, is a yellowish crystalline substance having a pronounced odour of honey-civet character.

Thanaka is the name given by the Burmese to the accepted toilet cream of that country. The chief constituent is a yellow powder obtained from the bark and root of *Murraya Paniculata*, a flowering shrub of the N.O. Aurantiaceæ. The blossoms smell of jasmine, and the red

fruit has a strong odour of gooseberry. The tree attains a height of some 20 feet.

Theobroma Oil—*see* Cacao Butter.

Thiotrope Base is the name suggested for 4-aldehydophenyl thiocarbimide prepared by the interaction of thiocarbonyl chloride and 4-aminobenzaldehyde under suitable conditions. It forms white crystals which melt at 32° C. to a clear liquid, and has a strong odour which intensely resembles that of heliotropin. Dyson¹ attempted to utilise thiotrope base in the production of artificial pansy oil unsuccessfully. He obtained better results, however, in oils of the mezereon type. Four years ago the author was unable to obtain samples for confirmation, but was informed that arrangements were being made to produce it on a commercial scale.

Thuja-leaf Oil is obtained by distillation from the leaves and twigs of *Thuja occidentalis*, L., a tree belonging to the N.O. Coniferæ and found growing in the Pennsylvania district of the United States. It is known as *Arbor vitæ*, in North America as swamp cedar and white cedar, and should not be confounded with *Juniperus virginiana*, L., the red cedar. The best raw material for distillation is obtained from those trees well exposed to sunlight and the highest yield of oil when the steam pressure is great in the still. The apparatus used is of a primitive character. Thuja-leaf oil of best quality is colourless and possesses a peculiar odour reminiscent of bornyl acetate and male fern. It contains thujone, fenchone, pinene and borneol. This oil has a limited use in perfumery and is used as a fixative.

Thus—*see under* Olibanum.

Thyme-muscat Oil has recently been offered as a substitute for clary sage, but comparison is odious.

Thymene is obtained as a by-product in the isolation of thymol from ajowan oil, and is used as a soap perfume.

¹ "P. and E.O.R." (1929), 3.

It is a mixture of hydrocarbons, consisting principally of cymene.

Thyme Oil occurs in the drug trade in two forms, "red" and "white," the former owing its colour to the imperfect distilling apparatus used during its manufacture. French oils are considered the finest, and the "white" is merely the "red" which has been rectified in stills having condensers of tinned copper. About forty species of thyme have been identified by botanists in Spain and Southern France but the probable botanical sources of this oil are as follows :—

French from *Thymus vulgaris*, L.

Spanish from *T. zygis*, var. *gracilis*, Boiss.

T. vulgaris, L., and

T. capitatus, Hoff et Link.

In the mountainous districts of that part of France bordering on the Mediterranean, the herb grows abundantly and is found as high as three to four thousand feet. It is collected when in full flower during May and June and distilled fresh.

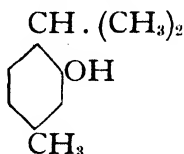
In Spain, thyme grows abundantly on the dry and gravelly soil of Aragon, Andalusia, Catalonia, Murcia, New Castille, and Valencia. In these neighbourhoods the plants hybridise rapidly, and it seems doubtful if commercial oils are ever distilled from any one species. Distillation of the herb takes place from May to August. Spanish oils are frequently of a greenish colour which may be accounted for by the botanical source of the raw material. Thyme oils from the Sevilla district generally contain carvacrol while those from the Murcia province are characterised by their thymol content.¹ French oils sometimes contain thymol and sometimes its isomer. Spanish oils generally exhibit a higher phenol content. These oils are used principally in soap perfumery where small proportions added to a compound will impart a remarkable fresh

¹ "P. and E.O.R." (1923), 220.

smell to the finished soap tablet. For this purpose French red thyme oil stands pre-eminent.

Thyme oil is occasionally used in making eau-de-Cologne and for flavouring liquid dentifrices.

Thymol is iso-propyl-meta-cresol, and occurs naturally in the oils of thyme and ajowan seeds. It has the formula



Commercially it is obtained by separation from the latter, and also from certain species of Spanish thyme oil which are rich in this phenol. Other oils have a high content of thymol, notably origanum and different species of *Ocimum*. The latter would probably be a valuable source for this substance. Thymol is now synthetically prepared from *p*-cymene,¹ from spruce turpentine,² and from meta-cresol.³ It is a white crystalline solid, melting about 51° C., boiling at 232° C., and liquefies when triturated with menthol, camphor, etc. It has a wide application in the manufacture of dental preparations, where traces only are necessary, and is considered by dentists as one of the finest antiseptics known.

Tilam Wangi is the name given to patchouli in the Straits Settlements.

Tilleul, or linden tree, *Tilia Europæa*, belongs to the lime tree family (Tiliaceæ), and is found wild in southern Europe and northern Asia. It is frequently cultivated for ornamental purposes, and its flowers are particularly fragrant. The perfume is imitated by mixtures of hydroxycitronellal, geraniol, linalol, methyl anthranilate, anisic

¹ "P. and E.O.R." (1920), 11; (1923), 257.

² "American Perfumer" (1923), 90.

³ "P. and E.O.R." (1923), 258; (1924), 185.

aldehyde, ionone, and benzyl acetate, fixed with musk ketone, benzoin, or Peru balsam.

Tin Oxide—see Stannic Oxide.

Ti-tree Oil—see Tea Tree Oil.

Titanium Dioxide, TiO_2 , occurs in the crystalline form in the minerals rutile, brookite, and anatase. It has been known for many years, but it is only during the past few years that it has been exploited commercially. Titanium dioxide is now largely used in paint manufacture, and a specially prepared amorphous variety of great purity is used as a pigment for toilet preparations. This is a dead white powder, devoid of odour and taste and is non-poisonous. It is lighter than zinc oxide and has greater covering power, and opacity. It has the advantage also of being both chemically and physiologically inert. This cosmétique pigment therefore is an important substance, and can be used wherever zinc oxide is at present employed. Experiments have shown its great value in face powders, compacts, grease paints, and liquid powders. The *Stearate* offers alternative uses to the similar salts of zinc and magnesium.

Tobacco Absolute has in recent years been prepared from French tobacco by the leading Grasse manufacturers. It is more commonly employed as a colourless resinoid prepared by extracting the leaves with volatile solvents. For imparting an attractive nuance in modern fashionable perfumes it is invaluable.

Tobacco Flavours—consult Volume II.

Tobacco Flowers emit a delicious perfume and the plant, a herbaceous perennial, is frequently grown in English gardens. The species, *Nicotiana affinis*, N.O. Solanaceae, is the sweet-scented variety bearing white star-shaped tubular flowers, the odour being most noticeable towards evening. *N. Persica* is another variety often found, and it constitutes the raw material for tobacco of Shiraz. Other commercial varieties are dealt with in the monograph on tobacco flavours in Volume II.

The perfume of English tobacco flowers is reminiscent of clary sage, tonka, rose, carnation and honey, and may be compounded on the following lines :—

150	Bergamot.
50	Clary sage.
200	Rose rouge.
100	Carnation.
50	Miel.
15	Birch tar oil.
20	Immortelle absolute.
200	Jasmin compound.
10	Dimethyl hydroquinone.
70	Tolu balsam.
100	Coumarin.
5	Vanillin.
30	Vetivert—Java.
<u>1000</u>	

The above may be varied with labdanum, olibanum, methyl ionone, and the iso-butyrate of phenylethyl and phenyl propyl alcohols.

Tolu Balsam is a resinous substance occurring in the schizogenous ducts of *Myroxylon toluiferum*, H. B. and K., a tree belonging to the N.O. Leguminosæ and attaining a height of about 70 feet. It is distributed throughout the northern part of South America and flourishes particularly in the valley of the Magdalena River, New Granada, and Venezuela. The lowest branches of the tree are about 40 feet from the ground. The balsam is collected by making a deeply cut V-shaped notch in the bark and affixing in its acute angle a calabash cup which retains the balsam as it exudes from the schizogenous ducts. Several of these incisions are made and cups fixed around the lower part of the tree trunk. When the base is well covered the incisions are made higher up and to reach them a crude scaffolding is fixed. As the calabashes become full they are emptied into gourds which are slung on the back of a donkey and thus transported to the coast where they are transferred into tins for export. The tree is bled for about eight months of the year.

Tolu balsam is at first a soft tenacious solid but it hardens with keeping, and in cold weather becomes quite brittle. It contains up to about 80 per cent of resin, together with benzoic and cinnamic acids, vanillin, benzyl benzoate, benzyl cinnamate, and a small quantity of volatile oil. The balsam has a soft, sweet hyacinth-like fragrance, and by reason of its high resin content becomes a very useful raw material in modern perfumery, especially as a fixative. It is also employed in soap perfumery and will blend well with cinnamic alcohol, coumarin, musk, etc. For use in high-class perfumery it is best manipulated after dilution with alcohol of equal weight when any undissolved matter is filtered out. A colourless tolu balsam is now available from most of the Grasse houses.

Further details, including the history of this valuable substance, will be found on referring to a paper by the author in an American periodical.¹

Toncarine is a crystalline compound melting at 73° C. and having a powerful odour of coumarin type. It is 6-methyl coumarin.

Tonka Beans are the seeds of two species of *Dipteryx*, trees attaining a height of about 80 feet and belonging to the N.O. Leguminosæ. Those from *D. odorata*, Willd., are known as "angostura beans" and are collected principally from trees growing in Eastern Venezuela and British Guiana. Those from *D. oppositifolia*, Willd., are designated as "para" beans, being smaller and not so valuable as the former. They come from Brazil. The trees grow singly, and occasionally only in small clumps, so that the collection of the seeds presents some difficulty. According to E. Albes² there is only one good crop every three years. The centre of the industry is situated at Ciudad Bolivar on the Orinoco River where the trees are known as *sarrapias* and the collectors of the seeds as *sarrapieros*. Albes says that whole families make their way up the river in boats and spend two or three months

¹ "American Perfumer" (1924), 365.

² *Ibid.* (1916), 278.

in gathering the crop. This takes place between February and May. The seeds are enclosed in an indehiscent drupaceous fruit about as large as an egg, and those which have fallen off the tree are collected by the natives and broken open between two stones. The seeds are dried in the sun and sold to dealers at the above-mentioned town. The crop is frequently damaged before being ready for collection as many of the birds and monkeys have a special predilection for the fruit. It is said that the monkeys eat the fruit but spit out the seeds, which, however, are picked up and sold by the natives. Before the beans are exported (Trinidad is the principal port) they are crystallised on the exterior by immersion in rum. They are placed in casks, open at one end, covered with this strong alcoholic liquor and allowed to soak for 24 hours. Any excess of rum is then run off and the beans spread out to dry in the air. They are swollen and at first black, but during the drying process they shrink and become covered with small crystals of coumarin. Tonka beans have a pleasant fragrance and contain about 3 per cent of coumarin. They are occasionally used in perfumery and as a tobacco flavour, but have been largely replaced by synthetic coumarin (*which see*).

Tonquinol is prepared by allowing nitric acid to act upon the sulphonic acids of butyl xylene. It is a sweet-smelling white powder, but does not appear to be much used. It is recommended as a fixative.

Tormentilla. Extracts are made by infusion or decoction of the rhizomes of *Potentilla sylvestris*, *P. repans*, *P. tormentilla* and other species of the N.O. Rosaceæ found growing in Europe and Northern Asia. They have remarkable astringent properties due to the presence of tannic acid and are of a deep reddish-brown colour containing tormentilla red, a decomposition product of tannin. It is this property which has led to the use of tormentilla extract, in dilute form, as a producer of artificial sunburn. The illusion is perfect.

Tragacanth is a gum, exuded after incision of the stems

of *Astragalus gummifer*, Lab., and other species of the N.O. Leguminosæ, shrubs growing in Asia Minor. It occurs in commerce as flakes or tears, and is miscible with alcohol, but in water swells to a gelatinous mass. It is the basis of greaseless hair creams and many of the so-called benzoin creams for the hands. Owing to its highly tenacious mucilage it is valuable in the preparation of several other cosmetics—see also Karaya Gum.

Tredecyl Aldehyde, $(C_{13})-CH_3 \cdot (CH_2)_{11} \cdot CHO$, is a body with an intensely powerful odour of nondescript type. It occurs naturally in the oil distilled from *Ocotea usambor-ensis*, a tree growing in East Africa and is used in traces for modifying the odours of violet, mimosa, cassie, and jasmin. It may be employed effectively for obtaining a new note in an otherwise commonplace perfume. This aldehyde is isomeric with methyl nonyl propionaldehyde, $CH_3 \cdot (CH_2)_8 \cdot CH(CH_3) \cdot CH_2 \cdot CHO$, has similar properties, and is prepared from methyl nonyl ketone.

Trèfle.—There are many varieties of clover, *Trifolium pratense*, N.O. Leguminosæ, the two most fragrant species being *Trifolium incarnatum* and *T. odoratum*. The former is common in England, while the latter, which possesses a delightfully sweet odour, is an Italian variety. Amyl salicylate, iso-butyl salicylate, or a mixture of methyl salicylate and vanillin, recall the odour of trèfle, and are extensively employed as the basis of this perfume. They are blended with ylang-ylang, clary sage, and oakmoss resin and fixed with either musk ambrette or benzyl iso-eugenol. Distinct notes can be obtained by the use of benzylidene acetone and linalyl acetate. For further details and formulæ reference should be made to the monographs on Orchids and Trèfle in Volume II.

Triacetin, or glyceryl triacetate, $C_3H_5(OOC \cdot CH_3)_3$, is used as a solvent and fixative. S.G., 1.165; B.P., 258° C.

Trichlor Phenyl Methyl Carbinyl Acetate, $C_6H_5 \cdot CH(OOC \cdot CH_3) \cdot CCl_3$, is a white crystalline substance

melting at 87° C. and having an intense and lasting odour of rose type. It is remarkably useful in soap.

Tricresyl Phosphate, $(C_7H_7)_3 \cdot PO_4$, is an almost in-odorous liquid much favoured as a plasticiser in nail enamels. It is practically non-evaporable. S.G., 1.187; M.P., 16° C.; B.P., 440° C.

Triethanolamine is a pale yellowish, viscous and very hygroscopic liquid having a slightly ammoniacal odour. In some respects it may be said to combine the properties of glycerine and ammonia in a single chemical compound which has the formula $N(CH_2 \cdot CH_2OH)_3$; B.P., 277° C. at 150 mm. S.G., 1.12. It is completely soluble in water, acetone, and alcohols, but only slightly soluble in hydrocarbons. The commercial product, containing approximately 5 per cent mono- and 18 per cent di-ethanolamine, differs little from the pure compound in its physical and chemical properties. The equivalent weight of triethanolamine ranges from 125 to 140,¹ and its alkalinity is about one-sixth that of ammonia. The pH value is approximately 10.2. It combines with free fatty acids in molecular proportions to form soaps, which are practically neutral, the pH being about 8. They are free from irritating effects upon the skin and are superlative dispersing and emulsifying agents.

Triethanolamine stearate is a hard wax-like soap which finds extensive application in cosmetics. The *oleate* is a semi-liquid product rather like petroleum jelly. The usual requirements for emulsification are between 2 and 4 per cent of triethanolamine and 5 and 15 per cent. oleic or stearic acids, each based on the weight of the oil to be emulsified. The procedure consists in dissolving the fatty acid with the oil in the correct proportions, heat being used if necessary to produce the "oil solution." The amine is dissolved with the desired amount of distilled water and this "water solution" brought to the same temperature as the "oil solution." The two are then mixed, agitation producing

¹ This is usually about 132 and represents the weight of the amine that will combine with the molecular equivalent of an acid, *i.e.* 284 stearic acid.

emulsification. The slight variations experienced in commercial triethanolamine, together with the dilution which occurs when the product is not stored in an airtight container, have some effect on the preparation of neutral soaps. Where accurate formulation is necessary, therefore it is desirable to determine the total alkalinity of the amine sample.

Triethanolamine is undoubtedly one of the finest emulsifying agents for toilet preparations because of its complete lack of any alkaline irritation effect. It is equally important for developing a pure white colour, an even texture and a consistency which is not affected by temperature. Its use in a cream aids the penetration of mineral oils and waxes, and at the same time it facilitates the use of difficultly emulsifiable substances such as petroleum, lanoline, and olive oil. Finally cosmetic creams prepared with this amine may be easily removed by washing. An example of a **Cleansing Cream** follows :—

250	White oil.	S.G.O. 860	} A
40	Anhydrous lanoline		
145	Stearic acid, triple pressed		
18	Triethanolamine		} B
500	Distilled water		
40	Diethylene glycol monoethyl ether		} C
7	Rose perfume compound		
<u>1000</u>			

Melt A by warming to 70° C. and pour into B at the same temperature. Stir vigorously to obtain uniform emulsion, then add C. Now stir gently until cold to avoid undue aeration.

The *linoleic acid ester* of ethanolamine is used as a solidifying agent for essential oils.

Trimethyl Hexanone, $C_9H_{16}O$, is a colourless and highly aromatic liquid which has been shown to occur naturally in the oil distilled from labdanum resin.

Triphenyl Phosphate, $(C_6H_5)_3 \cdot PO_4$, is an inodorous crystalline substance melting at 46° C. and boiling at 410° C. It is a valuable plasticiser.

Truffles were referred to by Theophrastus,¹ and also by Pliny,² who found them something of a mystery. To-day they are looked upon in the south-east district of France as a delicacy, being consumed mainly as a delicious omelette confection. They are cultivated in the districts where Lavandin thrives, particularly near Riez and Digne, and specifically under the nut trees which are much grown in these districts. Truffles are the fleshy fungus, consisting of the ascocarps of certain Tuberaceæ, one of the sub-groups of the Oscomycetes. The two principal species appear to be *Tuber cibarium* and *T. griseum* and possibly also *T. melanosporum*, to which is attributed a very fine bouquet and flavour. They emit a curious odour and are "unearthed" by dogs and pigs. In the latter case the truffle is taken from the animal and an acorn refunded for its successful find. Locally they are packed in tins for transport and often in alcohol to preserve their bouquet. The possibility of their use in perfumery was investigated at the author's suggestion by Messrs. Pilar Freres, who extracted them with alcohol and also with petroleum ether. Some perfumers are of the opinion that their use in chypre perfumes would prove successful, but the mildness of their odour compared with that of oakmoss makes comparison impossible. The only chemical body having an odour reminiscent of truffles is laurinyll propionate. Recently an analysis was made by R. Arnaud and G. Igolen,³ who obtained 0.143 per cent of volatile oil of unknown composition.

Tuberose, *Polianthes tuberosa*, N.O. Amaryllidaceæ, is cultivated in the South of France, the crop being collected during August, September, and October. The perfume of the flowers is obtained by cold enfleurage or by extraction with volatile solvents, the former method giving a higher yield. The following bodies have been identified in the essential oil: methyl benzoate, methyl anthranilate, benzyl benzoate, methyl salicylate, and benzoic acid, together with

¹ I, vi, 5.² Book xix, Chap. 11.³ "Les Parfums de France" (1937), 2.



FIG. 44.—Gathering Tuberoses.

[Roure-Bertrand Films.

[To face page 406.

a ketone named **Tuberone**. The following are probably also present : benzyl alcohol, geraniol, nerol, eugenol, and farnesol. As a rule the enfleurage product is considerably richer in methyl anthranilate. For further details and formulæ reference should be made to the monograph in Volume II.

Tulip is a bulbous plant, *Tulipa Gesneriana* and other species of the N.O. Liliaceæ. It is said to be a native of the Levant, and appears to have been cultivated in England about 1577. The original or wild plants, probably *Tulipa sylvestris*, have yellow flowers, but cultivation has produced numerous beautiful varieties, varying largely both in colour and size. In the early part of the seventeenth century some of these varieties were so famous that high prices were paid for the bulbs, which in Holland became a speculative mania, known as "tulipomania." It is said that one bulb fetched as much as 4200 guilders, but this ruinous traffic was ultimately stopped by the State. For many years tulips have been favourite objects of cultivation and competition among florists in this country, and a very large business is still done by firms in Holland. The only variety of this genus which possesses any marked odour is the "sweet tulip," *Tulipa suaveolens*. It flowers during March and April, and its odour recalls that of Maréchal Niel roses. Tulip perfumes are not in much favour and are seldom compounded. The following formula will give some idea of their composition :—

400	Rhodinol.
100	Phenylethyl alcohol.
200	Alpha ionone.
4	Iso-butyl acetate.
100	Guaiacwood oil.
80	Benzyl acetate.
1	Benzaldehyde.
5	Undecalactone, 10 per cent.
20	Jasmin absolute.
30	Rose absolute.
30	Rose otto.
30	Musk ketone.
<u>1000</u>	

Turmeric Oil is obtained from the rhizomes of *Curcuma longa*, L., plants belonging to the N.O. Zingiberaceæ, and grown in the East Indies, Cochin China, etc. It is a viscous yellow liquid with a characteristic odour of the rhizomes. The yield of volatile oil is about 4 per cent and it contains phellandrene and a ketone named turmerone.

Turtle Oil has recently been brought forward again as a useful raw material for cosmetics and soaps. It was discarded some years ago by at least one leading English perfumery house on account of its very doubtful efficacy. Turtle oil was reputed to have been used by Cleopatra, but even centuries ago the Mayas and Mexican Indians employed it as a body skin beautifier. The Indians in South America used it as a foodstuff, production being effected in the Amazon regions. According to Navarre and Ruszkowski,¹ over 100,000 gallons have been produced annually, more than half of which is used by the Indians, the remainder being exported from Para, Brazil. Some of this oil, as also that from the Seychelles, is extracted from turtle eggs and is claimed to have the same nutritive value as cod-liver oil. There are three different methods of securing the oil : 1, by modern steam distillation of turtle fat and liver ; 2, as a by-product in the large-scale production of turtle soup ; and 3, by boiling the fat in kettles and separating the oil which floats to the surface. Crude oils are refined by washing, bleaching, and filtration, before being offered to the cosmetic industry. Turtle oil plants are found in lower California, Mexico, Egypt, Brazil, and Panama, the raw material consisting of the livers and eggs of the green Atlantic and Pacific turtles, also the so-called loggerhead and leatherback varieties. Astringent properties are claimed for the oil supposed to be extracted from the giant sea turtle *Chelonian Athecæ*, Sp. *Sphargidæ*.

Turtle oils of commerce vary in colour according to the source and also to the method of refining. The best are greyish-white, others are yellowish to golden-brown.

¹ "American Perfumer" (March, 1933), 16.

Some are solid, melting about 20° C., while others are liquid at room temperature. These deposit high melting stearins on standing. The best grades have least odour, which is reminiscent of cod-liver oil; others are almost nauseating; many readily develop rancidity.

The use of turtle oil in cosmetics is advocated presumably by reason of its vitamin content, but having regard to the above remarks, manufacturers are advised to approach the problem with due care and attention. If turtle oil is to be used, then a high percentage should be employed if a reasonable amount of efficiency is to be anticipated. The question of perfuming should not be ignored, because unless the basic odour is blended in with the perfume compound poor results may be expected. Jasmin with orange seems to be most successful, and experiments on the following lines may prove advantageous :—

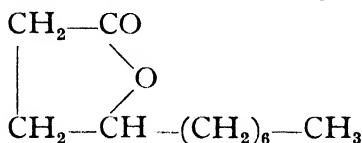
400	Sweet orange oil.
200	Benzyl acetate.
100	Linalyl acetate.
80	Geraniol palmarosa.
30	Amyl cinnamic aldehyde.
20	Methyl cinnamate.
4	Undecalactone.
1	Methyl nonyl acetaldehyde.
100	Methyl ionone.
40	Musk ketone.
25	Methyl naphthyl ketone.
<u>1000</u>	

Claims made for cosmetics containing turtle oil must be carefully substantiated, and it is, of course, of primary importance to be reasonably sure that the oil purchased is, in fact, in accordance with the description of the source.

Umburana Seeds are collected from *Amburana Claudii*, Schwacke et Taube, N.O. Leguminosæ, large trees growing in the Brazilian State of Minas Geraes. They smell fairly strongly of coumarin and are used locally for perfuming tobacco. The wood also exhales the same odour and is much prized for making household utensils. Consignments

of the seeds occasionally appear on the English market. (*Compare also Tonka Beans.*)

Undecalactone is a highly odorous liquid sold generally under the name peach lactone and having the formula



It is erroneously named aldehyde C_{14} or tetradecyl aldehyde. Undecalactone is used for imparting a fruity note to all kinds of fancy bouquets, and in flower perfumes it finds application in jasmin and some roses.

Undecylenic Alcohol, $\text{CH}_2 : \text{CH} . (\text{CH}_2)_8 . \text{CH}_2\text{OH}$, is a liquid prepared synthetically, but occurring naturally in the oil from the leaves of *Litsea odorifera* (oil of trewas). It is used as a modifier in small quantities only in perfumes of rose type. S.G., 0.852; B.P., 250° C.

Undecylenic Aldehyde, $\text{CH}_2 : \text{CH} . (\text{CH}_2)_8 . \text{CHO}$, is a liquid having an intense penetrating odour of rose type. It is used with other aldehydes for imparting a new note to fancy perfumes. S.G., 0.842 at 20° C.; B.P., 118° C. at 13 mm.

Undecylic Acid, $\text{C}_{10}\text{H}_{21}\text{COOH}$, is an unctuous creamy-white solid of slight but not unpleasant odour. The use of 0.2 per cent will, according to patent 454,970, improve the spreading and absorbitive qualities of cosmetics. The patent also covers all saturated fatty acids having an uneven number of carbon atoms from C_9 to C_{17} .

Undecylic Alcohol, methyl nonyl carbinol, $\text{CH}_3 . (\text{CH}_2)_7 . \text{CH}_2 . \text{CH}(\text{CH}_3)\text{OH}$, occurs naturally in Algerian oil of rue and is now synthetically prepared. It is a liquid with an odour of nondescript type, and resembles alcohol C_{10} in general properties. S.G., 0.833 at 24° C.; B.P., 245° C. The *normal* alcohol has the formula, $\text{CH}_3 . (\text{CH}_2)_9 . \text{CH}_2\text{OH}$.

Undecylic Aldehyde, $\text{CH}_3 \cdot (\text{CH}_2)_9 \cdot \text{CHO}$, is a liquid at normal temperatures with a powerful, indescribable odour reminding of rose and incense. It is useful in traces for modifying floral compounds. This aldehyde, chemically, belongs to the saturated series and is synthesised by the oxidation of *a*-hydroxylauric acid. This acid is prepared from methyl laurate which is obtained by treating coco-nut butter with methyl alcohol containing HCl gas in solution. S.G., 0.825; B.P., 104°C . at 10 mm.

Upalet—*see* Costus.

Usnea Plicata, Ach., is a lichen sometimes collected with, and used as an adulterant for, oakmoss (*which see*).

Valerian Oil is distilled from the erect rhizome and roots of *Valeriana officinalis*, L., N.O. Valerianaceæ, a plant cultivated in Europe and Asia. The dried roots are generally used for distillation, and they yield about 1 per cent of a brownish coloured oil having the characteristic clinging valerian odour. The composition of this oil has been investigated by various chemists who have identified as constituents valeric acid, bornyl acetate, formate, butyrate and valerate, pinene and camphene. It is used in medicine and as a tobacco flavour.

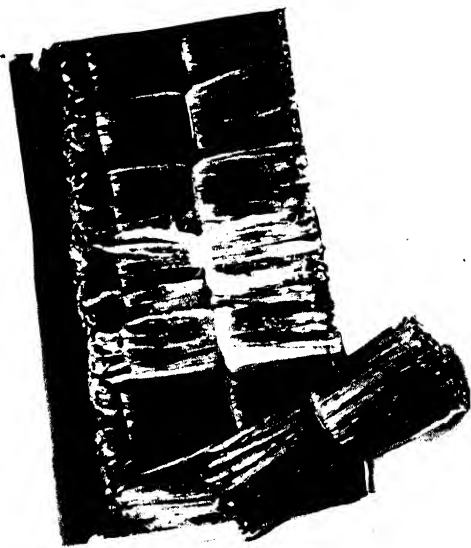
Spikenard and other species belonging to the N.O. Valerianaceæ bear a close relationship to the common valerian. This matter has received the attention of two well-known botanists.¹

Vanilla Pods are the prepared unripe fruits of *Vanilla planifolia*, Andr., and other species, particularly *V. pompana*, Schiede, plants belonging to the N.O. Orchidaceæ and indigenous to tropical America and cultivated in Bourbon, Madagascar, Tahiti, Java, etc. The most esteemed variety is the Mexican, but owing to its high price and scarcity, it is largely replaced in European commerce by the pods imported from Bourbon and Madagascar. This orchid is a climbing plant (a vine) bearing flowers having both male

¹ A. Meunissier, "La Parfumerie Moderne" (1922), 255; E. M. Holmes, "Perfume Record" (1924), 53.

and female organs. The pistil and stamens, however, are separated by the thin membranous skin of the labellum so that only on rare occasions does fertilisation take place without human assistance. Natives are employed who artificially fertilise from 700 to 1000 flowers in a morning by means of a fine needle or small piece of wood the size of a toothpick. They merely lacerate the labellum beneath the anther and so allow the pollen to fall on the pistil. The vanilla plant thrives best as a climber on young trees, and according to C. Chalot¹ those grown in Madagascar for the purpose are *Iatropa Curcas* (the Barbadoes purging nut tree) and *Casuarina equisetifolia* (the ironwood tree). These trees afford adequate protection by shading the plants from the terrific heat of the sun's rays. Chalot says that a vanilla plantation is started by planting cuttings of the vine, about a yard long, and containing several nodes, at the foot of the supporting trees, which should be about one year old. Only a few inches of these cuttings are placed below the ground and they soon take root. The vine is trained so that it does not grow too high for convenient pollination. Old banana stalks are used as fertiliser. A plantation lasts under ten years, and if conditions have been conducive will yield four or five crops of beans during this period. The beans soon begin to develop after pollination and about 90 per cent of the flowers are productive. The harvest is collected while the beans are still unripe and just when they begin to turn yellow at the ends. If they are allowed to become too green, they become woody after curing. The beans take about seven months to reach this stage and the harvest is over in two or three months. When picked they are odourless. The curing process is responsible for the aroma of vanilla and after sorting the pods into long, short, and broken grades, this is effected as follows: They are immersed in water at a temperature of about 63° C. for two or three minutes, and then packed in barrels lined with wool to undergo the sweating process for twenty-four hours. They are then placed on trays

¹ "La Parfumerie Moderne" (1923), 63, 83.



[R. C. Treat & Co., Ltd.
FIG. 45.—A 20 lb. case of Bourbon Vanilla—6 inch pods.
[To face page 412.

covered with cloths and exposed to the sun for about six hours a day over a period of six or seven days. Chalot says that if the sunlight fails, this stage of the process is supplanted by artificial heat in a dryer kept at about 46° C. for four days. The last and most difficult part of the curing process is the slow air drying in the shade, the beans being spread out on trays in a large drying shed and inspected daily for from four to six weeks. When the pods have become sufficiently shrunken, hard, and wrinkled, they are again graded, tied into bundles, and packed in parchment-lined tins containing 20 to 25 lb., three of these going into one case. The yield varies but is approximately 1 cwt. per acre.

In Mexico the vanilla plant is grown principally in Vera Cruz, the centre of the industry being Papantla and Misantla, and the port of export Tuxpam. The beans from the semi-wild plantations are sold to expert curers, or else the farmers engage an expert who visits the different districts. At Misantla the beans are not so good and three indigenous varieties are known, *viz.* cimarron, mansa, and mestiza. When cured, these are said to be practically indistinguishable. The curing process in Mexico differs from that described above in that the beans are exposed to the sun on white-washed cement platforms instead of being immersed in hot water. Most of the Mexican vanilla is now bought by the United States. South American vanilla comes from Guadeloupe and is very much like the Mexican in odour. The curing is generally effected without immersion in water, but the beans are first "needled" by making four scratches on the outer surface of the green pod from end to end, deep enough to break through the skin. This is done to allow the moisture to escape during the sweating process and to prevent excessive splitting while exposed to the sun.

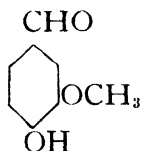
In Réunion, Bourbon vanilla is produced much on the same lines as that given under Madagascar (above), and indeed it may be said that the process, cultivation, etc., was borrowed in the first place from Réunion. Bourbon

vanillas probably account for the major part of those consumed in Europe. Tahiti, in the French Society Islands, was at one time a very important centre for the cultivation of this orchid, but of late years the quality has*depreciated to such an extent that this variety is not found in large quantities in the European market but probably goes to China. Vanilla beans become dark brown while being cured and are generally coated with castor or olive oils to preserve them. The development of the odour appears to be due to fermentation. The pods are about 20 cm. in length and filled with very small, black, shining seeds, which adhere to each other owing to the glutinous balsam with which they are coated. A whitish bloom consisting of vanillin crystallises on the surface of each bean. Vanilla contains about 2 per cent of vanillin together with anisic aldehyde, anisic alcohol, and free anisic acid. Doubtless other, so far unidentified, substances occur and help to produce the characteristic odour which is only reproduced in part in synthetic vanillin.

Vanilla is largely used as a flavour in the form of an alcoholic tincture. It has also a limited use in fine perfumery but is largely replaced by vanillin in the great majority of flower compounds. In the preparation of face powder perfumes, vanilla is very useful. It is also employed as a tobacco flavour. Recently an absolute essence of vanilla has been prepared in Grasse. This is made by exhausting the cut beans with alcohol in a shaking apparatus for one month. The extract is run off, the marc pressed, and the liquors mixed with the first runnings. This is filtered, the colour eliminated, and the solvent nearly all removed *in vacuo*. Vanilla absolute is a very excellent article and by far the best form in which this very valuable natural product may be employed. It is used in all types of fine perfumes and particularly in those of an Oriental quality.

Vanillin is a white or yellowish-white crystalline (needles) substance, melting from 81° to 84° C. according to its purity. It is prepared artificially on a large scale both in Europe and America, and may be obtained from

iso-eugenol by oxidation, from guaiacol by the introduction of an aldehyde group, and from protocatechuic aldehyde by methylation. In England vanillin is made by the first-named process and the raw material consists of clove oil. The eugenol is separated from this by treatment with caustic soda and subsequently liberated with mineral acid. It is then converted into iso-eugenol by fusion with caustic potash at 220° C. and afterwards separated by means of mineral acids. The acetyl derivative of iso-eugenol is then prepared and subsequently oxidised into acetyl vanillin, the aldehyde being separated by sodium bisulphite. The acyl vanillin is treated with mineral acid and after liberation is saponified with alkali. The vanillin is separated by treatment with acid. In America attempts have been made to oxidise iso-eugenol direct by passing ozone gas through this substance mixed with a solution of bisulphite but so far this has not proved a commercial success. Vanillin was at one time liable to adulteration with acetanilide and benzoic acid. Acetiso-eugenol is occasionally found as an impurity due to faulty purification, the product in consequence having an inferior odour. Vanillin is methyl protocatechuic aldehyde, and has the following chemical constitution :—



Vanillin is found in nature in the balsams of Peru and Tolu, in gum benzoin, and may be seen on the surface of the vanilla bean, where it crystallises as a whitish bloom. It has recently been observed by E. O. von Lippmann¹ as a constituent of the blue flowers of the potato plant. Vanillin is one of the important articles used by the perfumer, being extensively employed as a fixer, modifier, and blender. If judiciously applied it will "sweeten" any perfume and combines well with heliotropin, coumarin, and

¹ Schimmel & Co., "Report" (1919), 76.

benzyl iso-eugenol for giving "body" to a "thin" odour. In cases where it is not advisable to use heliotropin, traces of benzaldehyde or methyl acetophenone added to it will after maturing produce an odour effectually resembling piperonal. Vanillin has a limited application in soap perfumery as it has a tendency to turn the soap brown in time. In combination with small quantities of coumarin, it is the basis of all cheap essences of vanilla.

Veratrine is a mixture of several of the alkaloids obtained from cevadilla, the dried ripe seed of *Schænocaule officinale*, Asa Gray, N.O. Liliaceæ, a plant grown in Mexico. It is a very poisonous body and is violently sternutatory. Veratrine is used in preparations for the hair.

Verbena Oil (genuine) is obtained from the leaves of *Verbena triphylla*, L'Hérit (*Aloysia citriodora*, H. B. and K.), N.O. Verbenaceæ, a plant believed to be a native of Chili, and now cultivated in Algeria, Tunisia, and the South of France, where most of the oil is distilled. The yield to distillation with cohobation is from 0.1 to 0.7 per cent. A considerable acreage of verbenas is cultivated by Antoine Chiris in Algeria, but during the author's visit in 1939, distillation of the oil had been discontinued owing to the poor demand for the genuine product. The dried leaves, however, had a large sale for the domestic preparation of the well-known and highly appreciated infusion. The shrub is a small one rarely exceeding 4 feet in height. The leaves are verticillate in threes, they are nearly sessile, lanceolate; the inflorescence is terminal; flowers of a pale mauve colour, irregular and insignificant. In the South of France the plant is generally called *verveine citronelle*. There are two crops of leaves each year, in July and October, and the yield varies between four and six thousand kilos per hectare. The volatile oil is a yellowish liquid with a fragrant, lemon-like odour and is infinitely superior to the so-called verbenas oils, which are in reality obtained by distilling the leaves with lemon-grass oil or alternatively with purified citral from lemon-grass. The general characters of the two oils show a close resemblance, which is attributed to the citral contained by both; genuine



[W.A.P.]

FIG. 46.—Young *Verbena* plants on the Chiris Farms at Boufarik, Algeria.

[To face page 416.]

verbena oils, however, have about 30 per cent of this aldehyde, whereas in lemon-grass oils the percentage lies between 65 and 70. A genuine verbena oil distilled on the estate of Antoine Chiris at St. Marguerite-Boufarik has recently been examined by Mme. and M. G. Igolen,¹ who were able to identify the following constituents : traces of acetic acid ; 33 per cent aldehydes and ketones as citral, methyl heptenone, carvone, and furfural ; 4 per cent oxide as cineole ; 22 per cent terpene as *l*-limonene ; 15 per cent sesquiterpenes as dipentene and *d*- β -caryophyllene ; 20 per cent alcohols as linalol, borneol, nerol, geraniol, nerolidol, and cedrol ; together with traces of nitrogenous substances as pyrrol. These oils should not be confused with **Spanish Verbena Oil**, which is distilled from *Thymus hyemalis*, Lange, N.O. Labiatae. The following constituents have so far been identified in genuine oils from either France or Spain : citral, geraniol, *l*-limonene, myrcene, cineol, verbenone, methyl heptenone, and *d*-citronellol together with sesquiterpene derivatives. The synthetic substance so far prepared which has an odour closely approximating to that of verbena is cymylacetic aldehyde (*which see*). Verbena oil blends well with the citrus oils in the preparation of eau-de-Cologne, and is readily distinguishable in a well-known French product. It also blends well with orris, iso-eugenol, rose, and heliotropin, and is admirably fixed by means of benzoin, elemi, or olibanum. Toilet waters or eau-de-Verveine are very refreshing after a bath and may be prepared as follows :—

400	Verbena oil.
100	Geraniol—Java.
100	Methyl ionone.
30	Clove oil.
20	Rose absolute.
100	Bergamot.
200	Lemon.
30	Neroly.
20	Musk ketone.
<u>1000</u>	

¹ "Parfums de France" (1938), 113, 139.

Vert de Violette is the name given to methyl heptene carbonate (*which see*).

Vetivenol, $C_{15}H_{24}O$, is the aromatic sesquiterpene alcohol present in oil of vetivert. It is a yellowish viscous liquid having the sweet fragrance of the parent roots, without their characteristic grassy note, and is separated from the oil by fractionation. Vetivenol gives rise to a number of interesting esters. That from Java oil has the finest odour. Vetivenol blends well with all santal type products including cinnamyl acetate, coumarin, and musk ambrette.

Vetivenyl Acetate is a viscous oil of light yellow colour and having a sweet, fragrant, and persistent odour of santal type. It blends very well with this oil, and makes in this combination an excellent base for chypre perfumes.

Vetivenyl Butyrate has similar characteristics to the above, excepting that the odour has a fruity note.

Vetivenyl Formate has a very fragrant odour.

Vetivenyl Propionate is less interesting.

Vetivenyl Valerianate is an oil having a fragrance which suggests its application in tobacco flavours.

Vetivert Oil is a viscous dark brown liquid having a remarkably persistent odour, and is obtained from *Vetiveria zizanioides*, Stapf., N.O. Graminaceæ. The plant is a tall, erect perennial tufted grass, growing wild in different parts of India, where the roots are known as khus-khus, and are often woven into mats for covering windows, etc. Vetivert is also cultivated in the Bourbon Islands, Java, Jamaica, the Malay Peninsular, etc. In India the grass is found in abundance throughout the province of Travancore and particularly in the neighbourhood of Tutikorin. When vetivert is cultivated propagation is effected by root division. A proportion of the raw material for distillation is sent to Europe, although good oils are distilled in Réunion, Java, etc. The roots are harvested when the new cuttings are being planted out, the best soil for the new

plantations being volcanic sand or ash. The oil is obtained by steam distillation of the roots, which are first coarsely ground and digested with water. Distillation is slow as the boiling-point of the oil is high, and two fractions (light and heavy) can be separated by first using the steam jacket of the still and afterwards applying direct steam at high pressure. English vetivert oils are considered to be much finer products than foreign oils, and this may be due to their being single distillates. Javanese oil is less expensive; Réunion oil is still cheaper, and the difference in odour may be attributed either to the above cause or to the fresher nature of the raw material. The yield of oil from dry roots is about 2 per cent. When fresh it has a raw grassy odour suggestive of potatoes. If kept for some months this gradually disappears. The constituents so far identified are vetivenol and vetivene, an alcohol and hydrocarbon respectively. Vetivert oil is one of the finest fixatives known and is much used for this purpose. Traces are sufficient for the rose and opoponax type of perfume, while much larger quantities may be employed in conjunction with patchouli as a basis for perfumes of Oriental type. The following will give pleasant results :—

300	Vetivert—Java.
300	Santal.
100	Rose rouge.
200	Methyl ionone.
50	Patchouli.
50	Musk ambrette.
<u>1000</u>	

By extracting the roots with volatile solvents a resinoid is obtained which offers a cheap and good substitute for the oil. This substance finds useful application in soap perfumery especially as a fixer for violet odours when it is blended with ionone, cedarwood, cananga, benzyl acetate and orris.

Violet.—*Viola odorata* is a perennial herb of the N.O. Violaceæ, native to this country, but largely cultivated in

the South of France for its perfume. It is used to some extent in medicine as syrup of violets. All violet perfumes have as their base ionone or methyl ionone, together with modifiers and blenders. The finest varieties contain a proportion of natural violet extract. For further details reference should be made to the monograph in Volume II.

Violet Ketones—see Ionone and Methyl Ionone.

Violet Leaves are extracted by volatile solvents for their extremely odorous principles, and no violet perfume can be said to be perfect without the addition of this product. Its odour is slightly earthy and far from attractive. It is imitated artificially by methyl octine carbonate (*which see*). The extract is obtainable either as a concrete or as a colourless liquid—the latter product being much easier to handle and more esteemed. In violet compounds up to 5 per cent may be employed for “leafy” effects, but for normal compositions $\frac{1}{2}$ to 1 per cent should not be exceeded. Walbaum and Rosenthal have recently examined an ethereal oil from green violet leaves and have found as the main constituent an aldehyde $C_9H_{14}O$, containing an open unbranched chain of nine carbon atoms. Späth and Keszler¹ have recently confirmed the constitution of this aldehyde as nonadeine 2·6-al-1.

Viridine—see Phenyl Acetaldehyde Dimethyl Acetal.

Vitamins are substances of complex composition occurring in minute traces in natural foods and essential for the normal nutrition and growth of the human body. Their absence from our diet produces specific deficiency diseases. In view of the known efficacy of their oral application, is there anything to be gained by their external application as a constituent of cosmetics, and, moreover, how can we obtain absolute experimental proof of their absorption by the epidermis? Even supposing that any positive answer can be found to these queries, is not the cosmetician poaching upon the preserves of medicine by employing them, pro-

¹ “Ber. D. Ch. G.,” 67 (1934), 1496-1500.



FIG. 47. Violets.

[*Antoine Chiris.*

[*To face page 420.*

viding always that he advertises special claims for his goods attributed to their vitamin content?

In view of these conditions the author prefers, in this volume, to refer only to the vitamins in an abstract form and to leave his readers to judge for themselves as to the desirability of employing them.

Vitamin A is a product of plant metabolism occurring in such vegetables as spinach, lettuce, peas, and beans. As pro-vitamin A it occurs as the yellow colouring matter carotene in carrots and tomatoes. From animal sources it occurs also in cod liver oil, egg yolk, butter, cream, and milk. Vitamin A acts as a resistant to infection throughout the entire human body and promotes growth, reproduction, and longevity.

Vitamin B is a nitrogenous compound occurring in its most concentrated form in brewer's yeast. It is also present in cereals, citrus fruits and tomatoes, egg yolk, milk, meat, and vegetables. Vitamin B is not effected by heat but is destroyed by alkali. Soda therefore should not be added to vegetables and, owing to its solubility in water, the liquids obtained in cooking should be set aside and used for soups. Vitamin B promotes growth, and a large consumption is necessary for reproduction and lactation.

Vitamin C occurs in cabbages, potatoes, citrus fruits, tomatoes, etc., and being prone to oxidation is destroyed by prolonged cooking. Hence dried cereals do not provide the body with this vitamin, which is essentially a resistant to infection.

Vitamin D belongs to the sterol group and is the only one of these bodies capable of development in the human organism. Known also as irradiated ergosterol, it results from the exposure of the epidermis to the vital ultra-violet rays of the sun, and to some extent also to artificial sources of light. Fish oils constitute the best sources of vitamin D but it is also present in egg yolk, milk, butter, and cream, and to a reduced extent in green vegetables. The presence of this vitamin in the body is essential to the deposition of calcium and phosphorus in the skeletal tissues. Lack of it

causes rickets, induces anemia, nervousness, and possibly respiratory infection.

Vitamin E occurs in the oil of the wheat germ, seeds, cabbage, lettuce, spinach, sprouting grains, etc., and is generally present in plenty in our normal varied diet. It is essential for reproduction of the species and lack of it may cause sterility.

Vitamin F is the name given to some of the unsaturated fatty acids such as linoleic and linolenic. It has received considerable publicity in the cosmetic trade, the main claims as to its efficacy being based upon its prevention of certain forms of dermatitis in the tail of the rat. Non-partisan scientific observers are so far loth to accept the rather exaggerated claims made for it.

Viverra Civetta and Zibetha—*see* Civet.

Wallflower.—*Cheiranthus cheiri* is a perennial plant of the N.O. Cruciferae, and is frequently known as giroflée. Garden varieties are numerous and very popular on account of their fragrance. The flowers yield about 0.06 per cent of essential oil by extraction with volatile solvents, and distilling the extract with steam. Wallflower perfumes may be prepared synthetically, and are based upon anisic aldehyde and the rose alcohols, but none are perfect without traces of *p*-cresol methyl ether. For further details reference should be made to the monograph in Volume II.

Waxes.—Several varieties of waxes are useful in the manufacture of toilet articles, but only the unimportant ones are briefly described here. Others such as white beeswax, cetaceum, etc., are dealt with under their own names.

Carnauba Wax is a hard, inodorous, and tasteless solid extracted from the leaves of *Copernicia cerifera*, N.O. Palmæ. Chief constituents—cerotic acid and myricyl alcohol.

Chinese Wax (Insect Wax) is an insect secretion from *Coccus ceriferus*, and resembles cetaceum. Chief constituent—ceryl cerotate (*which see*).

Japan Wax is extracted either by volatile solvents or

hot pressure from the fruit of *Rhus succedanea*, N.O. Anacardeæ, and is a by-product of the lacquer industry. Its principal constituents are palmatin and its acid. It is a hard brittle substance, emulsifying readily with water and melts from 50° to 54° C. It is used in the preparation of pomades, and when mixed with castor oil, and *repeatedly melted*, makes a transparent article. Japan wax has a useful application also in lipsticks.

Montan (Montana) Wax in its crude form is dark brown in colour but when distilled with super-heated steam it assumes a clean white appearance and melts about 100° C. It is extracted from the lignites of Saxony and Thuringia and may be used in lipsticks as a hardening agent.

Myrtle Wax is obtained when the berries of *Myrica cerifera*, N.O. Myrtaceæ, are boiled with water. It is a hard green solid and is imported from America. Chief constituent—palmatin.

Wax Perfuming Compounds—see Honey.

White Oil—see Paraffin Liquid.

Wild Pimento Oil has been distilled in Jamaica from the leaves of *Amonis Jamaracensis*, N.O. Scitaminæ. It has a fragrant odour, somewhat resembling that of spike lavender. It has been examined by O. D. Roberts¹ who found it to contain 15 per cent of cineole, 38 per cent of alcohols, chiefly *l*-linalol and some geraniol, 1.5 per cent of linalyl acetate, 17 per cent of terpenes, and about 0.1 of phenols and aldehydes. The remainder consisted principally of sesquiterpenes with traces of acetic and caproic acids. It would probably prove to be useful for perfumery purposes, if it could be supplied regularly in quantity.

Wine Oil—see Cognac Oil.

Wintergreen Oil—see under Gaultheria.

Wistaria—see Glycine.

Witch Hazel—see Hamamelis.

¹ "J. Soc. Chem. Ind.," 40 (1921), T. 95.

Wool Fat—see Lanolin.

Wormwood Oil, also known as absinthe oil, is obtained by distillation of the leaves and tops of *Artemisia absinthium*, L., N.O. Compositæ, a plant native of northern Africa and southern Europe, and cultivated widely in the United States. The oil is of a greenish to bluish colour and possesses the characteristic and somewhat unpleasant odour of the herb. It is used principally in the preparation of the liqueur *absinthe*.

Xolisma Absolute is obtained by extraction with volatile solvents from *X. ferruginea*, a plant of the N.O. Ericaceæ, found growing in the undergrowth of the Florida Jungle and extending as far as South Carolina. The shrub closely resembles sweet myrtle and until quite recently was erroneously known by this name. It attains a height of about 10 feet, the flowers forming clusters containing up to 100 blossoms. These resemble wax-like berries and emit a characteristic fragrance reminiscent of lily backed up with hydroxy-citronellal and phenyl acetaldehyde. The perfume was first extracted with benzol by E. G. Thomssen and J. R. Johns,¹ who obtained a quantity of dark yellow extract which they separated into flower oil, resin, and fatty material. The former bodies had an intense odour of the flowers treated. Xolisma is known also as Sour Wood and Sorrel Tree.

Yara Yara—see β -Naphthol Methyl Ether.

Ylang-Ylang Oil is obtained by distillation from the flowers of *Cananga odorata*, Hook. (and possibly another species *Cananga latifolia*), trees attaining a height of about 60 feet and belonging to the N.O. Anonaceæ. The plant is cultivated in the Philippines, Réunion, and Java. Manila, in the first-named group of islands, is the centre where the finest oil is produced. A good oil, having, however, less bouquet, is produced in the French Colony while the Dutch East Indies yield the cheaper cananga

¹ "American Perfumer" (November, 1930), 542.

oils. These differences in quality of a volatile oil distilled presumably from the same botanical species have led to a good deal of conjecture as to the reasons. The general consensus of opinion is that the geographical distribution of the trees is more likely to account for the differences than the dissimilar *modus operandi* in the distillation processes. This problem received the attention of de Jong some years ago,¹ who proposed to obtain some data for its solution by securing seedlings from the Philippines and transplanting them in Java.² Furthermore, differences are noticed in the oils distilled in Manila and other provinces of the Philippines. This dissimilarity is explained by Bacon,³ who says that distillers in the latter do not choose their fractions correctly or else burn the blossoms during the distillation process.

In Manila the ylang-ylang tree blossoms throughout the year, but the best flowers are generally picked by the natives during the nights of May and June. The highest yield and the best quality oil are obtained from fully developed yellow blossoms, but Bacon says the natives frequently deliver to the distiller flowers which are green and immature. To obtain 1 kilo of finest oil, 350 to 400 kilos of flowers are necessary. When this quantity of oil has been collected in the receiver it is removed and the distillation process continued. By this means a further yield of inferior oil is obtained. Slow distillation with steam from fresh water gives better results than water which has been condensed from previous distillations, since this contains acetic and probably formic acids which have a tendency to decompose the esters present in the oil.

In Réunion ylang-ylang was first distilled in the year 1893. Propagation of the plant is by means of seeds

¹ "Teysmannia" (1908), 578, through Schimmel's "Report" (April, 1909), 27.

² Consult the monograph on Cananga Oil.

³ "Philippine Journal of Science," 3 (1908), A. 65, through Schimmel's "Report" (November, 1908), 128.

placed from 15 to 20 feet apart. The trees grow quickly, and when they are about 7 feet high (after three years) the terminal buds are removed. This causes branches to be thrown out, and makes the harvest much more easy as the trees develop in a horizontal direction and the flowers can be reached by hand.¹ When the buds open the flower still has little or no perfume. The petals are green and covered with a multitude of white hairs. As they enlarge the green colour diminishes and the hairs disappear. At the end of fifteen to twenty days, the flower, first of a pale colour, becomes quite yellow and emits a powerful and agreeable odour, perceivable at a distance. The flowers are collected in the early morning by women and children and placed in bags suspended from their necks. Those yellow blossoms, touched with red in the centre, which are withering are picked, this being the proper degree of maturity. This harvest is made about once a week and for preference during warm and sunny weather. In Réunion the flowers can be collected all the year round, but the greatest yield is experienced from November to March. A fully developed tree will produce from 20 to 30 kilos of blossoms per season, but according to this French publication it averages from 5 to 10 kilos. The flowers contain about 2 per cent of volatile oil, but if this yield is obtained the oil is of poor quality. In practice a still of 1 hectolitre capacity containing 15 kilos of flowers gives 150 grams of oil in nine hours (*i.e.* 1 per cent), steam distillation being employed. It is the custom in this French Colony to fractionate the oil, the second runnings being rectified to produce a good second quality oil. The first runnings consist principally of oxygenated bodies and esters, whereas the large proportion of sesquiterpenes come over with the second fraction.

The following constituents have so far been identified : para-cresol methyl ether, geraniol, linalol (and probably their acetic and benzoic acid esters), cadinene, pinene,

¹ "Bulletin de l'Agence Générale des Colonies," 200, through "P. and E.O.R." (1925), 127.

benzyl alcohol, iso-eugenol, eugenol, methyl eugenol, methyl anthranilate, methyl benzoate, methyl salicylate, benzyl benzoate, benzyl acetate, benzaldehyde and isosafrole. Nerol, farnesol, and valeric acid may be present in some oils. The composition of ylang-ylang oil has been subject to considerable research by L. S. Glichitch and Y. R. Naves,¹ and these authors' account should be referred to by those interested.

Ylang-ylang oil is much used in high-class perfumery and is replaced in cheap perfumery and soaps by cananga oil. It blends well with bois de rose oil, amyl salicylate, phenylethyl cinnamate and vetiver oil as the basis of face powder perfumes. It is much used as a modifier in artificial violets and lilacs. It may be fixed with any of the crystalline synthetics or natural plant gums and resins, and will advantageously supply the dominating odour note in many Oriental perfumes. Artificial ylang-ylang oil is generally built up along the lines of its known composition and with skill can be produced at the price of ordinary cananga oil, with many more times its strength. Modern perfumes almost invariably contain the finest ylang-ylang which costs about double that of ordinary Manila grade. An example of such a creation is given as a basis for experiment :—

100	Lilac.
30	Lily of the valley.
20	Ylang-ylang.
10	Santal.
10	Bergamot terpeneless.
6	Rose absolute.
10	Jasmin absolute.
2	Methyl nonyl acetaldehyde, 10 per cent.
2	Vanillin.
10	Musk ketone.
30	Musk extract, 3 per cent.
1000	Alcohol.
1230	

Ylang-ylang *Absolute* is now obtainable, and its odour is much finer than that of any of the foregoing oils.

¹ "Les Parfums de France" (1932), 7 and 36.

Zdravets Oil is obtained by distillation from the leaves of *Geranium macrorrhizum*, L., a small perennial plant indigenous to certain altitudes of the northern shores of the Mediterranean and to the Balkans. The plant attains a height of from 12 to 16 inches, has green leaves sometimes covered with reddish spots, and purplish rose flowers appearing from May to July. The plant has been cultivated for many years in Central and Southern Europe for medicinal and ornamental purposes. In Bulgaria it is taken as an aphrodisiac.

This species of geranium has recently attracted the attention of one of the large perfumery houses in Grasse, and they have prepared an oil by distillation and an absolute by extraction with petroleum ether.

The oil at normal temperatures is a greenish semi-crystalline mass (compare marocaine oil) having an intense and persistent odour reminiscent of clary sage. The absolute has a fuller and more persistent note, and when examined by the author retained its odour on strips of absorbent paper for at least ten days. The principal constituent is a body having the formula $C_{15}H_{22}O$, and has been named germacrol.

Zdravets absolute is one of the newest raw materials of perfumery, and therefore well worth the attention of perfumery chemists. Its fragrance, reminiscent of clary sage and heather, combined with amber and rose water, immediately suggests its application in perfumes of the Fougere type, a formula for which is appended (see p. 429).

Zedoary Oil is distilled from the rhizomes of *Curcuma Zedoaria*, Roscoe, N.O. Zingiberaceæ, a plant cultivated in Ceylon. It is a somewhat viscid liquid of a greenish-black or reddish colour, and its odour recalls a mixture of ginger and camphor. Cineole has been identified as a constituent.

Zibethin is the name sometimes given to the civet obtained from the musk-rat, *Viverraz zibetha*, a native of Asia, particularly Arabia, China, and the Philippines. It is employed in the form of a strong tincture—see Civet. It is also the name given to synthetic civets (*which see*).

30	Zdravets absolute.
170	Lavender oil—M.B.
200	Bergamot oil.
5	Tarragon oil.
30	Jasmin absolute.
60	Rose absolute.
10	Tuberose absolute.
5	Jonquille absolute.
5	Cassie absolute.
120	Jasmin artificial.
200	Rose artificial.
30	Oakmoss absolute.
20	Tonka resinoid.
15	Orris concrete.
5	Civet absolute.
5	Castoreum absolute.
10	Patchouli oil—extra.
15	Vetivenyl acetate.
5	Vanillin.
20	Coumarin.
10	Musk ambrette.
30	Musk ketone.
1000	

Zibetone—*see* Civet.

Zinc Carbonate, ZnCO_3 , occurs as a white powder, and is obtained when hydrogen sodium carbonate is added to a solution of zinc sulphate. When normal sodium carbonate is employed, basic zinc carbonate, $\text{ZnCO}_3 \cdot 2\text{Zn(OH)}_2 \cdot \text{H}_2\text{O}$, is obtained. These products are used as constituents of toilet powders.

Zinc Hydroxide, Zn(OH)_2 , is formed as a white flocculent precipitate, when either ammonia, caustic potash or soda is added to a solution of zinc sulphate. When this precipitate is filtered out and washed it makes a useful constituent for face enamels.

Zinc Oxide, ZnO , is obtained when the carbonate is heated to redness. It occurs as a dead-white powder and is known also as zinc white and Chinese white. It is much used in face powders on account of both its covering

power and adhesiveness. It is sometimes employed in frictional nail polishes.

Zinc Phenolsulphonate—*see* Zinc Sulphocarbolate.

Zinc Pyrophosphate, $P_2O_5 \cdot 2ZnO$, is a fine, light insoluble amorphous white powder admirably suited for use in face powders. Known as P.P. pigment, it is free flowing and without the "balling" properties associated with zinc oxide. The product varies considerably in its behaviour according to the method of preparation. Particular care must be taken to guard against the formation of double salts of the type $Na_4P_2O_7 \cdot 4Zn_2P_2O_7 \cdot 12H_2O$, which are crystalline and quite unsuitable for use as a cosmetic pigment.

Zinc Stearate, $[CH_3(CH_2)_{16}COO]_2Zn$, is one of the well-established compounds for use in cosmetic powders and creams. It is a light, smooth, unctuous, white powder possessing remarkable adherent qualities and has real hygienic properties. It is prepared from sodium stearate by the addition of a warm solution of zinc acetate. The precipitate is washed, dried and finely sifted. In face powders it may be used up to 10 per cent, but the resulting product is rather light. Half this quantity is about the ideal medium. When used in creams it will whiten the skin to which it is applied, but not to such a noticeable degree as the effect produced by the use of zinc oxide. Many face powder manufacturers prefer the magnesium salt.

Zinc Sulphocarbolate, $(C_6H_4[OH]SO_3)_2Zn \cdot 8H_2O$, is a colourless, efflorescent crystalline or fine white powder, soluble in alcohol and water. It possesses well-known astringent properties which are made use of in deodorant dusting powders. Five per cent is usually combined with 10 per cent of zinc stearate and 85 per cent of talc, suitably perfumed.

APPENDIX I.

NOMENCLATURE OF SYNTHETICS.

IN these notes the term *synthetics* has been adopted because it is generally used by perfumery chemists and perfumers. It would, of course, be more correct to refer to these substances as *carbon compounds* or *organic compounds*.

Both phenylethyl alcohol and geraniol occur in essential oils and are carbon compounds; the former is, however, strictly speaking, a *synthetic* because the commercial article is "built up" by synthesis from the other substances, whereas commercial geraniol is separated from an essential oil by fractional distillation and is therefore an *isolate*.

Carbon Compounds contain the element carbon in union with other elements such as hydrogen, oxygen, nitrogen, chlorine, bromine, sulphur, etc. Typical examples of these are—

H—Methane— CH_4 ; Limonene— $\text{C}_{10}\text{H}_{16}$.

O—Ethyl alcohol— $\text{C}_2\text{H}_5\text{OH}$; Acetic acid— $\text{CH}_3 \cdot \text{COOH}$.

N—Indole— $\text{C}_8\text{H}_7\text{NH}$; Nitrobenzene— $\text{C}_6\text{H}_5 \cdot \text{NO}_2$.

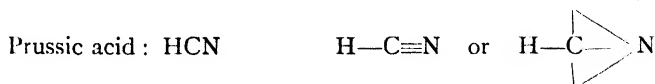
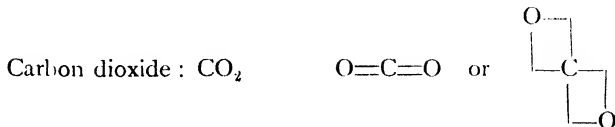
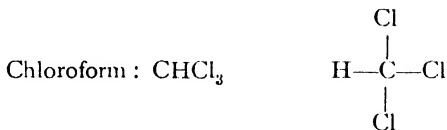
Cl—Chloroform— CHCl_3 ; Carbon tetrachloride— CCl_4 .

Br—Bromstyrole— $\text{C}_6\text{H}_5 \cdot \text{CH} : \text{CHBr}$.

S—Allyl iso-thiocyanate— $\text{C}_3\text{H}_5\text{N} \cdot \text{CS}$.

Linking of carbon atoms depends upon valency.

Carbon is *quadrivalent*—that is, the atom of carbon is capable of uniting with four atoms of a univalent element, two atoms of a bivalent element, or one atom of a tervalent and one atom of a univalent element, as follows:—

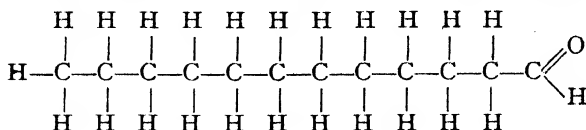


432 PERFUMES, COSMETICS AND SOAPS

Carbon Chains occur in the graphic formulæ for all synthetics and are of three well-defined types.

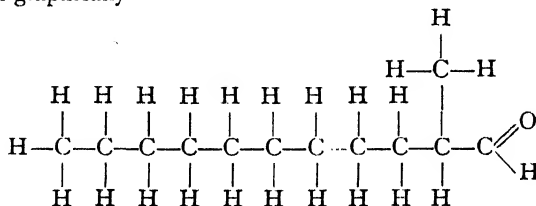
Straight or open chains are used when each carbon atom is in direct union with not more than two others, as follows:—

Duodecylic aldehyde, $\text{CH}_3 \cdot (\text{CH}_2)_{10} \cdot \text{CHO}$, is written graphically



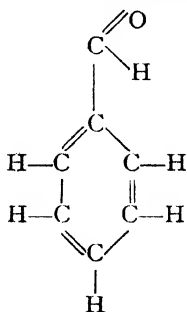
Branched chains are used when a carbon atom is in direct union with three or four others, as follows:—

Methyl nonyl acetic aldehyde, $\text{CH}_3 \cdot (\text{CH}_2)_8 \cdot \text{CH}(\text{CH}_3) \cdot \text{CHO}$ is written graphically



Closed chains are used when the carbon atoms (and sometimes atoms other than carbon) are in direct union with one another to form a *ring* or *cycle*, as follows:—

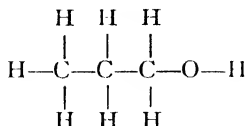
Benzaldehyde, $\text{C}_6\text{H}_5 \cdot \text{CHO}$, is written graphically



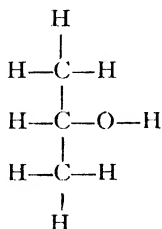
Isomers are different compounds represented by one formula, that is to say *isomerides* have the same number of each different atoms in the molecule but they are arranged differently. Put in another way the *structural* or *constitutional formula* is dissimilar. As an instance of this, duodecylic aldehyde and methyl nonyl acetic

aldehyde, referred to above, have the formula $C_{12}H_{24}O$, but the arrangement of the atoms is different. A simpler example is to be found in the propyl alcohols, C_3H_8O .

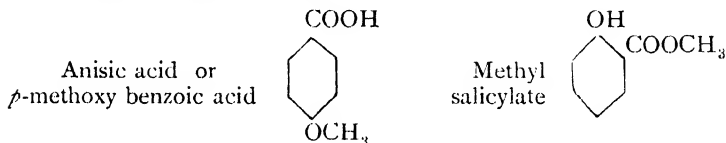
Normal propyl alcohol is $C_3H_7 \cdot OH$ or $CH_3 \cdot CH_2 \cdot CH_2OH$, or graphically



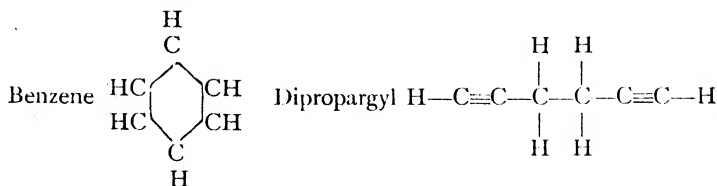
Iso-propyl alcohol is $(CH_3)_2 \cdot CHOH$ or $CH_3 \cdot CH(OH) \cdot CH_3$, or graphically



Two obviously different substances may be isomeric, for example anisic acid and methyl salicylate, $C_8H_8O_3$ —



An interesting example of isomerism is to be found in that of benzene and dipropargyl, C_6H_6 —



Homologues.—Homologous series are families of chemically related compounds, the composition of which varies from member to member by one atom of carbon and two atoms of hydrogen CH_2 . Homologues are therefore members of a series and are frequently

met with in organic chemistry. They are characterised by strong chemical resemblances which distinguish them from other classes of compounds. Their *physical properties*, such as their melting-points, boiling-points, densities, and solubilities, generally change uniformly as the number of carbon atoms increases. Usually the melting-points and boiling-points rise from the lower to the higher members of a homologous series. The following table of some familiar alcohols and acids will illustrate this:—

Alcohols.

			Boiling-point.
Methyl alcohol	CH_3O	.	66°C.
Ethyl	$\text{C}_2\text{H}_5\text{O}$	.	78°C.
Propyl	$\text{C}_3\text{H}_7\text{O}$	.	97°C.
Butyl	$\text{C}_4\text{H}_9\text{O}$	.	117°C.
Amyl	$\text{C}_5\text{H}_{11}\text{O}$	.	138°C.

Acids.

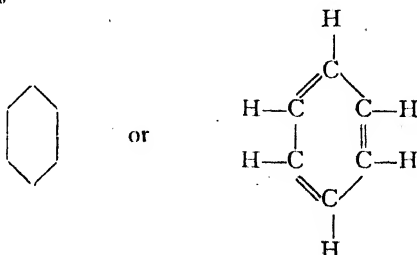
			Boiling-point.
Formic acid	CH_2O_2	.	101°C.
Acetic	$\text{C}_2\text{H}_4\text{O}_2$	.	118°C.
Propionic	$\text{C}_3\text{H}_6\text{O}_2$	.	141°C.
Butyric	$\text{C}_4\text{H}_8\text{O}_2$	.	162°C.
Valeric	$\text{C}_5\text{H}_{10}\text{O}_2$	.	185°C.

Classification.—There are two main groups of synthetics, the *aliphatic* and the *aromatic*.

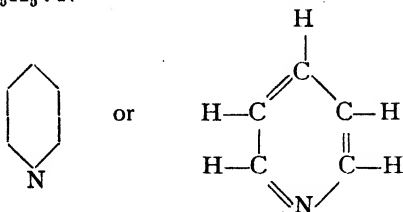
Aliphatic compounds are related to methane, CH_4 , and are *open* chain (straight or branched). They are so named from the fact that vegetable and animal fats belong to this series.

Aromatic compounds are related to benzene, C_6H_6 , and many are characterised by fragrant odours from which the name was originally taken. They are *closed* chain (ring or cyclic compounds). There are two main divisions:—

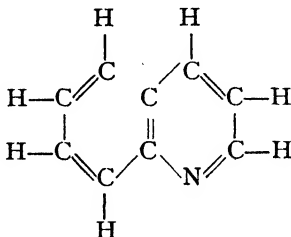
Carbocyclic compounds have a closed ring of *carbon* atoms as benzene, C_6H_6 —



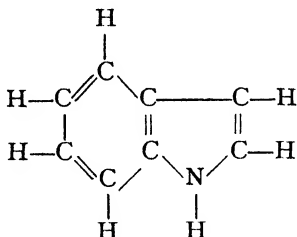
Heterocyclic compounds have a closed ring which may contain one or more atoms of other elements in addition to the carbon atoms, as pyridine, $C_5H_5 \cdot N$ —



Combinations of these two groups are also possible as quinoline, C_9H_7N —



or indole, C_8H_7NH —

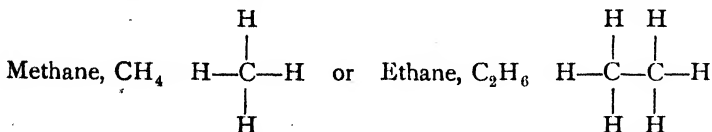


Both the aliphatic and aromatic series are subdivided into certain type compounds of which the following are important members.

ALIPHATIC SERIES.

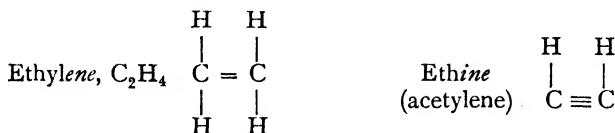
Hydrocarbons contain hydrogen and carbon only as the name implies.

The *paraffins* known also as the *alkanes* are saturated such as

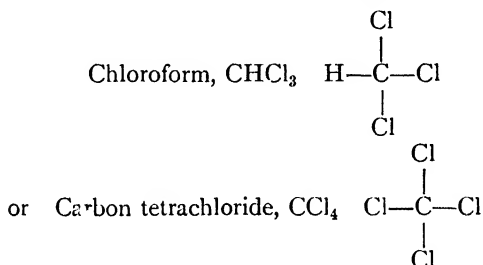


436 PERFUMES, COSMETICS AND SOAPS

The *olefines* known also as the *alkenes* and the *acetylenes* known also as the *alkines* are unsaturated such as



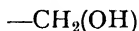
Halogen derivatives of the paraffins (fluorine, chlorine, bromine, and iodine) are formed by substitution. Examples are :



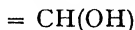
Alcohols may be regarded as oxygen derivatives of the paraffins or alternatively as hydrocarbons in which one or more hydrogen atoms are replaced by an *hydroxyl* group —OH. A list of the more important alcohols is appended :—

Methyl alcohol	CH_3OH
Ethyl alcohol	C_2H_5OH
Propyl alcohols	C_3H_7OH
Primary	$CH_3 \cdot CH_2 \cdot CH_2OH$
Secondary (iso-propyl)	$CH_3 \cdot CH(OH) \cdot CH_3$
Butyl alcohols	C_4H_9OH
Normal primary	$C_2H_5 \cdot CH_2 \cdot CH_2OH$
Normal secondary	$C_2H_5 \cdot CH(OH) \cdot CH_3$
Primary iso-butyl	$(CH_3)_2 \cdot CH \cdot CH_2(OH)$
Tertiary	$(CH_3)_2 \cdot C(OH) \cdot CH_3$
Amyl alcohols	$C_5H_{11}OH$
Normal primary	$C_2H_5 \cdot CH_2 \cdot CH_2 \cdot CH_2OH$
Iso-butyl carbinol	$(CH_3)_2 \cdot CH \cdot CH_2 \cdot CH_2OH$
Secondary butyl carbinol	$CH_3 \cdot CH(C_2H_5) \cdot CH_2OH$
Methyl propyl carbinol	$C_2H_5 \cdot CH_2 \cdot CH(OH) \cdot CH_3$
Methyl iso-propyl carbinol	$(CH_3)_2 \cdot CH \cdot CH(OH) \cdot CH_3$
Diethyl carbinol	$C_2H_5 \cdot CH(OH) \cdot C_2H_5$
Dimethyl ethyl carbinol	$(CH_3)_2 \cdot C(OH) \cdot C_2H_5$
Tertiary butyl carbinol	$(CH_3)_3C \cdot CH_2OH$

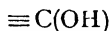
Primary alcohols have the hydroxyl group linked to an end carbon atom of a series and contain the group



Secondary alcohols have the hydroxyl group attached to a middle carbon atom of a straight chain, and contain the group



Tertiary alcohols have the hydroxyl group linked to a carbon atom which is attached to three other carbon atoms and contains the group—

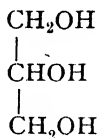


The carbon atom containing the hydroxyl group is known as the **Carbinol** group.

Glycols are dihydric alcohols of which the first member is now known as ethylene glycol—

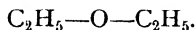


Glycerols are trihydric alcohols of which the simplest is glycerine—

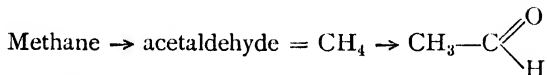


Ethers are organic *oxides* in which the H of the hydroxyl group is replaced by a radical, such as

Ether or diethyl oxide—



Aldehydes may be regarded as hydrocarbons in which a hydrogen atom has been replaced by a CHO group such as

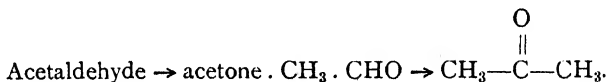


The principal members of the series are—

Formaldehyde	.	.	.	H . CHO
Acetaldehyde	.	.	.	CH ₃ . CHO
Propionaldehyde	.	.	.	CH ₃ . CH ₂ . CHO
Butyraldehyde	.	.	.	CH ₃ . (CH ₂) ₂ . CHO
Iso-butyraldehyde	.	.	.	(CH ₃) ₂ . CH . CHO
Valeraldehyde	.	.	.	CH ₃ . (CH ₂) ₃ . CHO
Iso-valeraldehyde	.	.	.	(CH ₃) ₂ CH . CH ₂ . CHO

Capron aldehyde	$\text{CH}_3 \cdot (\text{CH}_2)_4 \cdot \text{CHO}$
Heptaldehyde (œnanthic aldehyde)	$\text{CH}_3 \cdot (\text{CH}_2)_5 \cdot \text{CHO}$
Octyl aldehyde	$\text{CH}_3 \cdot (\text{CH}_2)_6 \cdot \text{CHO}$
Nonyl aldehyde	$\text{CH}_3 \cdot (\text{CH}_2)_7 \cdot \text{CHO}$
Decyl aldehyde	$\text{CH}_3 \cdot (\text{CH}_2)_8 \cdot \text{CHO}$
Undecyl aldehyde	$\text{CH}_3 \cdot (\text{CH}_2)_9 \cdot \text{CHO}$
Duodecyl aldehyde (laurinic aldehyde)	$\text{CH}_3 \cdot (\text{CH}_2)_{10} \cdot \text{CHO}$
Tredecyl aldehyde	$\text{CH}_3 \cdot (\text{CH}_2)_{11} \cdot \text{CHO}$
Tetradecyl aldehyde (myristic aldehyde)	$\text{CH}_3 \cdot (\text{CH}_2)_{12} \cdot \text{CHO}$

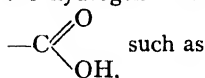
Ketones may be considered as aldehydes in which the H of the CHO group has been replaced by a radical, such as



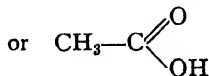
The principal members of the series are —

Acetone or di-methyl ketone	$\text{CH}_3 \cdot \text{CO} \cdot \text{CH}_3$
Propione or di-ethyl ketone	$\text{C}_2\text{H}_5 \cdot \text{CO} \cdot \text{C}_2\text{H}_5$
Butyrene or di-propyl ketone	$\text{C}_3\text{H}_7 \cdot \text{CO} \cdot \text{C}_3\text{H}_7$
Iso-butyrene or di-iso-propyl ketone	$(\text{CH}_3)_2 \cdot \text{CH} \cdot \text{CO} \cdot \text{CH} \cdot (\text{CH}_3)_2$
Iso-valerone or di-iso-butyl ketone	$(\text{CH}_3)_2\text{CH} \cdot \text{CH}_2 \cdot \text{CO} \cdot \text{CH}_2 \cdot \text{CH} \cdot (\text{CH}_3)_2$
Caprone or di-amyl ketone	$\text{C}_5\text{H}_{11} \cdot \text{CO} \cdot \text{C}_5\text{H}_{11}$
œnanthone or di-hexyl ketone	$\text{C}_6\text{H}_{13} \cdot \text{CO} \cdot \text{C}_6\text{H}_{13}$

Fatty Acids may be regarded as hydrocarbons in which one of the hydrogen atoms is replaced by a *carboxyl* group, $-\text{COOH}$ or



Methane \rightarrow acetic acid. CH_4 $\text{CH}_3 \cdot \text{COOH}$



Fatty acids are so named because several of them are contained in fats, such as—

Stearic acid from tallow— $\text{C}_{17}\text{H}_{35} \cdot \text{COOH}$.

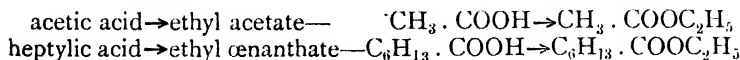
A list of the principal fatty acids is appended :—

<i>Acid.</i>	<i>Structural formula.</i>
Formic	H . COOH
Acetic	CH ₃ . COOH
Propionic	C ₂ H ₅ . COOH
Butyric	C ₃ H ₇ . COOH
Iso-butyric	(CH ₃) ₂ . CH . COOH
Valeric	C ₄ H ₉ . COOH
Iso-valeric	(CH ₃) ₂ . CH . CH ₂ . COOH
Methyl ethyl acetic	CH ₃ . C ₂ H ₅ . CH . COOH
Trimethyl acetic	(CH ₃) ₃ C . COOH
Caproic (iso-butyl acetic)	(CH ₃) ₂ . CH . CH ₂ . CH ₂ . COOH
Ænanthic (heptylic)	C ₆ H ₁₃ . COOH
Caprylic (octylic)	C ₇ H ₁₅ . COOH
Pelargonic (nonylic)	C ₈ H ₁₇ . COOH
Capric (decylic)	C ₉ H ₁₉ . COOH
Undecylic	C ₁₀ H ₂₁ . COOH
Lauric	C ₁₁ H ₂₃ . COOH
Tridecylic	C ₁₂ H ₂₅ . COOH
Myristic	C ₁₃ H ₂₇ . COOH
Isocetic	C ₁₄ H ₂₉ . COOH
Palmitic	C ₁₅ H ₃₁ . COOH
Daturic	C ₁₆ H ₃₃ COOH
Stearic	C ₁₇ H ₃₅ COOH
Arachidic	C ₁₉ H ₃₉ COOH

Substituted Acids have one or more of the hydrogens of the nucleus replaced by another group, such as

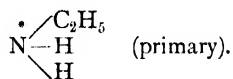
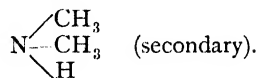
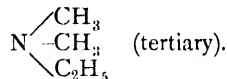
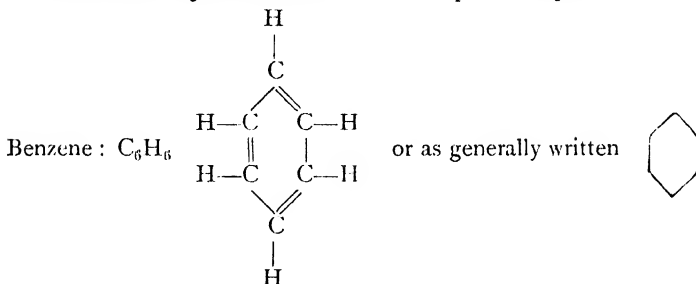


Esters may be regarded as acids in which the H of the carboxyl group has been replaced by a radical, such as



Amines are derived from ammonia, NH₃ or N $\begin{array}{c} \text{H} \\ \diagup \quad \diagdown \\ \text{H} \end{array}$ in which

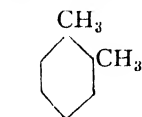
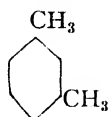
one or more of the atoms of hydrogen are replaced by alkyl groups, such as

Ethyl amine : $\text{NH}_2\text{C}_2\text{H}_5$ —Dimethyl amine : $\text{NH}(\text{CH}_3)_2$ —Dimethyl ethyl amine : $\text{N} \cdot (\text{CH}_3)_2 \cdot \text{C}_2\text{H}_5$ —**AROMATIC SERIES.****Aromatic Hydrocarbons.**—The simplest compound is

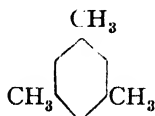
There are a number of homologues of which the more important are—

Toluene, known also as methyl benzene or phenyl methane, has the formula C_7H_8 or $\text{C}_6\text{H}_5 \cdot \text{CH}_3$.

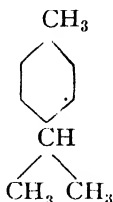
Xylenes or dimethyl benzenes have the formula C_8H_{10} or $\text{C}_6\text{H}_4(\text{CH}_3)_2$. There are three isomers, as follows :—

*ortho*-Xylene.*meta*-Xylene*para*-Xylene.

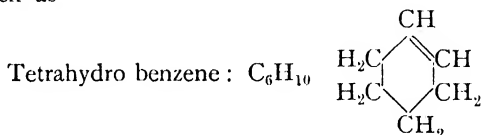
Mesitylene, 1.3.5, or symmetrical trimethyl benzene, has the formula C_9H_{12} or $\text{C}_6\text{H}_3 \cdot (\text{CH}_3)_3$ and is written graphically thus—



Cymene or *p*-methylisopropyl benzene, $\text{CH}_3 \cdot \text{C}_6\text{H}_4 \cdot \text{CH} \cdot (\text{CH}_3)_2$ is written thus—

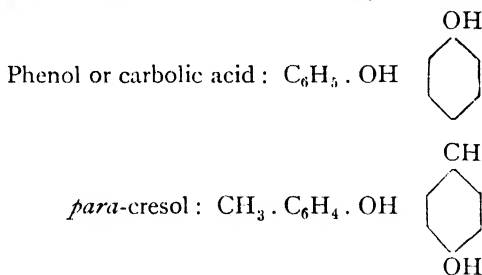


Hydroaromatic hydrocarbons are hydrogenated aromatic hydrocarbons, such as

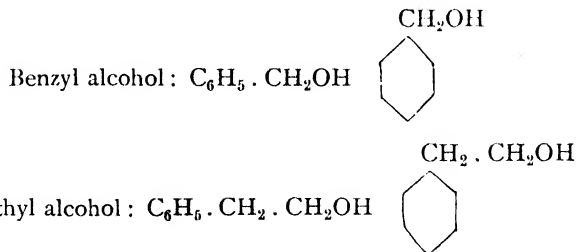


In the above examples such as cymene, the aromatic or benzenoid part is known as the *benzene nucleus* or simply, nucleus, whereas the paraffinoid or aliphatic part is referred to as the *side chain*.

Phenols or phenolic compounds contain a hydroxyl group attached to the nucleus of the aromatic hydrocarbon, such as

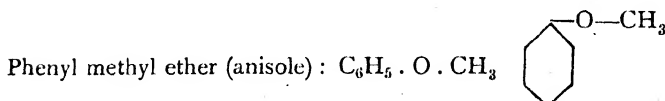
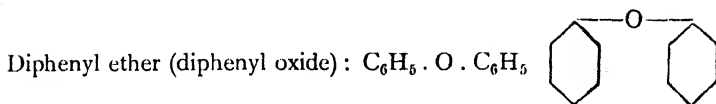


Aromatic Alcohols contain a hydroxyl group attached to the side chain, such as

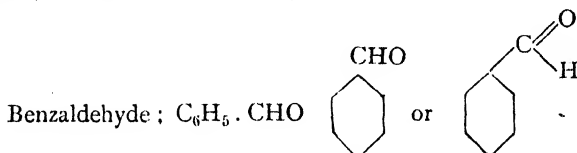


442 PERFUMES, COSMETICS AND SOAPS

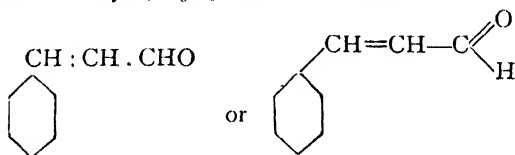
Aromatic Ethers are aromatic oxides, —O— , such as



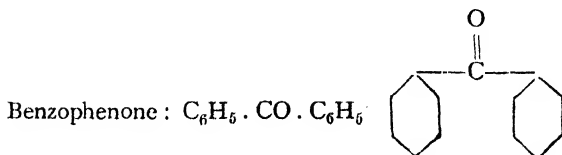
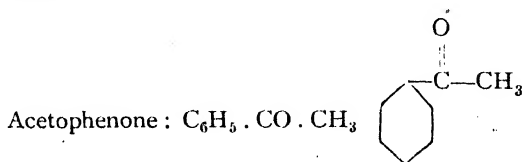
Aromatic Aldehydes have the —CHO group attached to the nucleus, such as



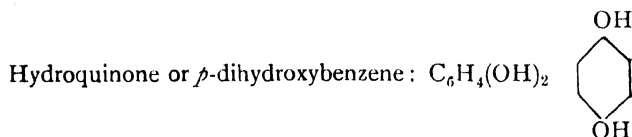
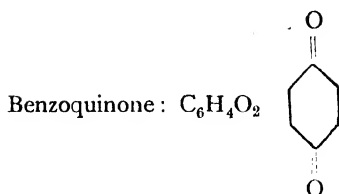
Cinnamic aldehyde, $\text{C}_6\text{H}_5 \cdot \text{CH} : \text{CH} \cdot \text{CHO}$



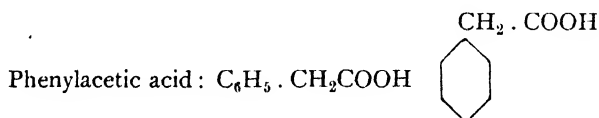
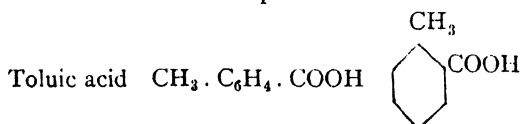
Aromatic Ketones have the =CO group attached to the nucleus, such as



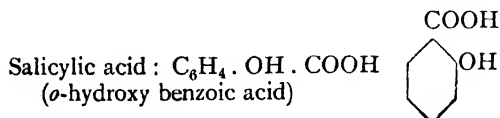
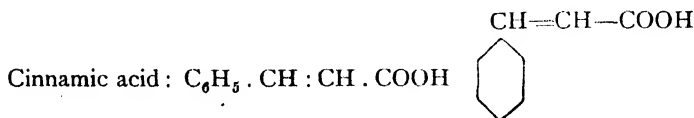
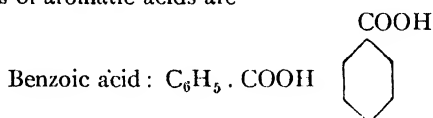
Quinones have two oxygens attached to the aromatic nucleus, such as

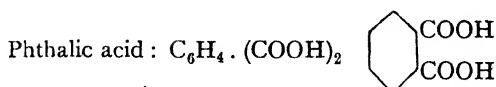


Aromatic Acids contain the carboxyl group $-COOH$ attached to the nucleus or to the side chain. The following two isomers will illustrate these two classes of compounds:—

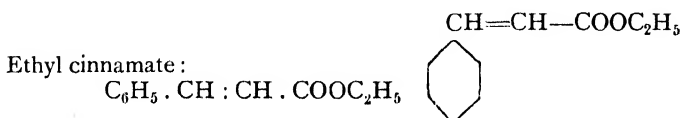
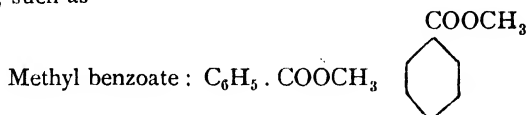


Other examples of aromatic acids are



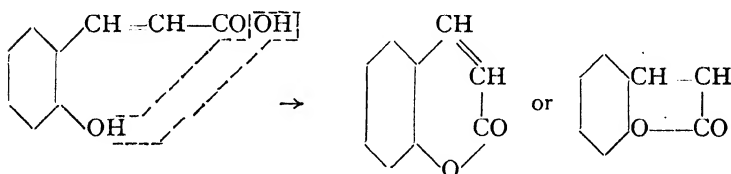


Aromatic Esters have the H of the aromatic acid replaced by a radical, such as



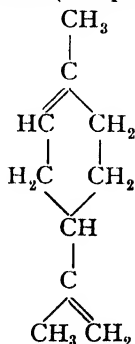
Lactones may be regarded as *inner esters* of hydroxy acids or alternatively as esters formed by the union of an alcohol and an acid both of which are part of the same molecule. A good example is

o-hydroxy cinnamic acid \rightarrow Coumarin



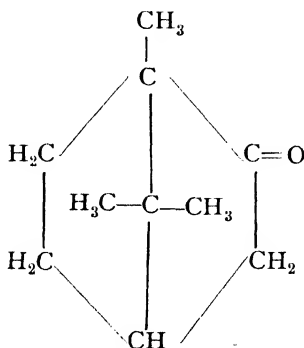
Terpenes are complex hydroaromatic hydrocarbons usually of the formula $C_{10}H_{16}$, such as

Limonene (or dipentene)

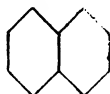


sesquiterpenes usually have the formula $C_{15}H_{24}$ and *polyterpenes* $(C_{10}H_{16})_x$.

Camphors are ketones of the formula $C_{10}H_{16}O$; ordinary camphor has the graphic formula



Naphthalene is an aromatic compound containing two condensed benzene rings, $C_{10}H_8$



Anthracene contains three rings, $C_{14}H_{10}$, thus—



WORD ENDINGS.

The Suffix	Indicates	Example.
-ane	paraffin	<i>methane</i>
-ene or -ylene	olefin	<i>ethylene</i>
-ine	acetylene	<i>ethine</i>
-ene	aromatic hydrocarbon	<i>xylene</i>
-ol	hydroxyl group	<i>cresol</i>
-al	aldehyde	<i>citral</i>
-one	ketone or quinone	<i>acetophenone</i>
-ic or -oic	acid	<i>benzoic acid</i>
-ate or -ite	ester	<i>methyl salicylate</i>

OTHER TERMS.

hydroxy indicates an hydroxyl group —OH.

ole, such as *indole* and *safrole*, is the ending given to compounds which do not contain the hydroxy group but have received names ending in *-ol*.

thio- indicates the replacement of oxygen by sulphur.

<i>o</i> -	„	ortho.
<i>m</i> -	„	meta.
<i>p</i> -	„	para.
<i>d</i> -	„	dextro.
<i>l</i> -	„	lævo.
<i>dl</i> -	„	racemic.
<i>sym</i> -	„	symmetrical.
<i>sec</i> -	„	secondary.
<i>tert</i> -	„	tertiary.
<i>meso</i> -	„	meso.
<i>Me</i> -	„	methyl.
<i>Et</i> -	„	ethyl.

In the following list the organic radicals have their formulæ opposite:—

Radical.	Formula.
Acetamido . . .	$\text{CH}_3 \cdot \text{CO} \cdot \text{NH}-$
Acetimido . . .	$\text{CH}_3 \cdot \text{C} (: \text{NH})-$
Acetonyl . . .	$\text{CH}_3 \cdot \text{CO} \cdot \text{CH}_2-$
Acetoxy . . .	$\text{CH}_3 \cdot \text{CO} \cdot \text{O}-$
Acetyl . . .	$\text{CH}_3 \cdot \text{CO}-$
Acetylene . . .	$=\text{CH} \cdot \text{CH}=-$
Acrylyl . . .	$\text{CH}_2 : \text{CHCO}-$
Allyl . . .	$\text{CH}_2 : \text{CH} \cdot \text{CH}_2-$
β -Allyl . . .	<i>See</i> Iso-propenyl
Amino or amido . . .	$\text{H}_2\text{N}-$
Amoxy . . .	$\text{CH}_3 \cdot (\text{CH}_2)_4 \cdot \text{O}-$
Amyl . . .	$\text{C}_5\text{H}_{11}-$ or $\text{CH}_3 \cdot (\text{CH}_2)_4-$
Amylidene . . .	$\text{CH}_3 \cdot (\text{CH}_2)_3 \cdot \text{CH}=-$
Anisal . . .	<i>p</i> - $\text{CH}_3\text{O} \cdot \text{C}_6\text{H}_4 \cdot \text{CH}=-$
Anisoyl . . .	<i>p</i> - $\text{CH}_3\text{O} \cdot \text{C}_6\text{H}_4 \cdot \text{CO}-$
Anisyl, <i>o</i> , <i>m</i> , or <i>p</i> . . .	$\text{CH}_3\text{O} \cdot \text{C}_6\text{H}_4-$
Anisylidene . . .	<i>See</i> Anisal.
Anthranilo . . .	O $\text{O}-\text{C}_6\text{H}_4 \begin{array}{c} \diagup \\ | \\ \text{N}- \end{array}$
Asparagyl . . .	$\text{H}_2\text{N} \cdot \text{CO} \cdot \text{CH}_2 \cdot \text{CHNH}_2 \cdot \text{CO}$
Azo . . .	$-\text{N} : \text{N}-$
Benzal . . .	$\text{C}_6\text{H}_5 \cdot \text{CH}=-$
Benzamido . . .	$\text{C}_6\text{H}_5 \cdot \text{CONH}-$
Benzoxy . . .	$\text{C}_6\text{H}_5 \cdot \text{COO}-$
Benzoyl . . .	$\text{C}_6\text{H}_5 \cdot \text{CO}-$
Benzoylene . . .	$-\text{C}_6\text{H}_4 \cdot \text{CO}-$
Benzyl . . .	$\text{C}_6\text{H}_5 \cdot \text{CH}_2-$

Radical.	Formula.
Benzylidene . . .	<i>See</i> Benzal.
Bornyl (from borneol)	$ \begin{array}{ccccccc} & & & & \text{C(CH}_3)_2 & & \\ & & & & / \quad \backslash & & \\ \text{CH}_2 & . & \text{CH} & . & \text{CH}_2 & . & \text{CH}_2 & . & \text{C(CH}_3)_2 & . & \text{CH} - \\ | & & & & & & & & & & | \\ 3 & & 4 & & 5 & & 6 & & 1 & & 2 \end{array} $
Bromo . . .	Br—
Butoxy . . .	CH ₃ . (CH ₂) ₃ . O—
Butyl . . .	CH ₃ (CH ₂) ₃ —
<i>sec</i> -Butyl . . .	$ \begin{array}{c} \text{CH}_3\text{CH}_2 \\ \diagup \quad \diagdown \\ \text{CH} - \end{array} $
<i>tert</i> -Butyl . . .	(CH ₃) ₃ C—
Butylene . . .	—CH ₂ . CH ₂ . CH ₂ . CH ₂ —[1, 4-form]
Butylidene . . .	CH ₃ . (CH ₂) ₂ . CH=
Butyryl . . .	CH ₃ . (CH ₂) ₂ . CO—
Carbamido . . .	H ₂ N . CO . NH—
Carbamyl . . .	H ₂ N . CO—
Carbonyl . . .	OC=
Carboxy . . .	HO . OC—
Carvacryl . . .	$ \begin{array}{c} (4) \text{ (CH}_3)_2\text{CH} \\ \diagup \quad \diagdown \\ \text{C}_6\text{H}_3 - (2) \end{array} $
Cetyl . . .	CH ₃ . (CH ₂) ₁₄ . CH ₂ —
Chloro . . .	Cl—
Cinnamal . . .	C ₆ H ₅ . CH : CH . CH
Cinnamenyl . . .	<i>See</i> Styryl.
Cinnamyl . . .	C ₆ H ₅ . CH : CH . CO—
Cinnamylidene . . .	<i>See</i> Cinnamal.
Cresoxy . . .	<i>See</i> Toloxy.
Cresyl (10 isomers)	
(<i>o</i> , <i>m</i> , or <i>p</i>) . . .	(HO)(CH ₃) . C ₆ H ₃ —
Cresylene . . .	<i>See</i> Tolylene.
Crotonyl . . .	CH ₃ . CH : CH . CO—
Cumal . . .	<i>p</i> -(CH ₃) ₂ CH . C ₆ H ₄ . CH=
Cumenyl . . .	(CH ₃) ₂ . CH . C ₆ H ₄ —
Cuminal . . .	<i>See</i> Cumal.
Cyclobutyl . . .	$ \begin{array}{c} \text{CH}_2 . \text{CH}_2 . \text{CH}_2 . \text{CH} - \\ | \quad \quad \quad | \\ \hline \end{array} $
Cyclohexenyl (from cyclohexene, 3 isomers) . . .	C ₆ H ₉ —
Cyclohexyl (from cyclohexane) . . .	C ₆ H ₁₁ —
Cyclohexylidene . . .	$ \begin{array}{c} \text{CH}_2 . \text{CH}_2 . \text{CH}_2 . \text{CH}_2 . \text{CH}_2 . \text{C} = \\ | \quad \quad \quad | \\ \hline \end{array} $

448 PERFUMES, COSMETICS AND SOAPS

Radical.	Formula.
Cyclopentenyl (from cyclopentene) .	C_5H_7-
Cyclopentyl (from cyclopentane) .	C_5H_9-
Cyclopropyl .	$CH_2 \cdot CH_2 \cdot CH-$ | |
Cymyl	(4) $(CH_3)_2CH$ (1) CH_3 \searrow $C_6H_5-(3)$
Decyl	$CH_3 \cdot (CH_2)_8 \cdot CH_2-$
Diazo	$-N : N-$
Duodecyl	$CH_3 \cdot (CH_2)_{10} \cdot CH_2-$
Ethenyl	$CH_2C \equiv$
Ethinyl	$CH : C-$
Ethoxalyl	$C_2H_5O \cdot OC \cdot CO-$
Ethoxy	C_2H_5O-
Ethyl	$CH_3 \cdot CH_2-$ or C_2H_5-
Ethylene	$-CH_2 \cdot CH_2-$
Ethylidene	$CH_3CH=$
Fenchyl (from fenchyl alcohol)	$C_{10}H_{17}-$
Fural (2 isomers)	$O \cdot CH : CH \cdot CH : C \cdot CH =$ | |
Furfural	See Fural.
Furfuryl	See Furyl.
Furfurylidene	See Fural.
Furoyl	$O \cdot CH : CH \cdot CH : C \cdot CO-$ | |
Furyl (2 isomers)	$O \cdot CH : CH \cdot CH : C-$
Furylidene	See Fural.
Geranyl (from geraniol)	$C_{10}H_{17}-$
Glyceryl	$-CH_2 \cdot CH \cdot CH_2-$
Glycolyl	$HOCH_2 \cdot CO-$
Glycyl	$H_2NCH_2 \cdot CO-$
Glyoxyl	$OCH \cdot CO-$
Guaiacyl	See <i>o</i> -Anisyl.
Hendecyl	See Undecyl.
Heptyl	$CH_3 \cdot (CH_2)_6-$ or C_7H_{15}
Hexadecyl	See Cetyl.
Hexyl	$CH_3 \cdot (CH_2)_5-$ or C_6H_{13}
Hydroxy or hydroxyl	$HO-$

Radical.	Formula.
Imino or imido . . .	NH=
Indyl (from indole, 7 isomers) . . .	C ₈ H ₆ N—
Indylidene (from in- dole) . . .	C ₈ H ₇ N—
Iodo . . .	I—
Iso-allyl . . .	<i>See</i> Propenyl.
Iso-amoxy . . .	(CH ₃) ₂ . CH . CH ₂ . CH ₂ O—
Iso-amyl . . .	(CH ₃) ₂ . CH . CH ₂ . CH ₂ —
Iso-butenyl . . .	(CH ₃) ₂ . C = CH—
Iso-butoxy . . .	(CH ₃) ₂ . CH . CH ₂ O—
Iso-butyl . . .	(CH ₃) ₂ CH . CH ₂ —
Iso-butyryl . . .	(CH ₃) ₂ . CH . CO—
Iso-cyano . . .	C : N—
Iso-hexyl . . .	(CH ₃) ₂ . CH . (CH ₂) ₃ —
Iso-propenyl . . .	$\begin{array}{c} \text{CH}_3 \\ \diagdown \\ \text{C}— \\ \diagup \\ \text{CH}_2 \end{array}$
Iso-propoxy . . .	(CH ₃) ₂ . CHO—
Iso-propyl . . .	(CH ₃) ₂ . CH—
Iso-thiocyano . . .	S : C : N—
Iso-valeryl . . .	(CH ₃) ₂ . CH . CH ₂ . CO—
Keto . . .	O=
Laurinyl . . .	<i>See</i> Duodecyl.
Malonyl . . .	—OC . CH ₂ . CO—
Menthyl (from men- thane) . . .	$\begin{array}{c} | \\ \text{CH}_3 . \text{CH} . (\text{CH}_2)_2 . \text{CH} (i\text{—C}_3\text{H}_7) . \text{CH}_2 . \text{CH}— \end{array}$
Mesityl (from mesi- tylene) . . .	3, 5—(CH ₃) ₂ . C ₆ H ₃ . CH ₂ —
Methene . . .	<i>See</i> Methylene.
Methenyl . . .	CH≡
Methoxy . . .	CH ₃ O—
Methyl . . .	CH ₃ —
Methylene . . .	CH ₂ =
Myristyl . . .	<i>See</i> Tetradecyl.
Naphthal . . .	C ₁₀ H ₇ CH=
Naphthobenzyl . . .	C ₁₀ H ₇ CH ₂ —
Naphthyl . . .	(1- or 2-)C ₁₀ H ₇ —
Naphthylene . . .	C ₁₀ H ₆ =
Nonyl . . .	CH ₃ (CH ₂) ₇ . CH ₂ —
Octyl . . .	CH ₃ . (CH ₂) ₇ —
Oxalyl . . .	—OC . CO—
Oxy . . .	—O—
Pentyl . . .	<i>See</i> Amyl.

Radical.	Formula.
Phenethyl . . .	$C_6H_5 \cdot CH_2 \cdot CH_2-$
Phenyl ethyl . . .	<i>See</i> Phenethyl.
Phthalal . . .	$=CH \cdot C_6H_4 \cdot CH=$ (<i>o</i>)
Phthalyl . . .	$-OC \cdot C_6H_4 \cdot CO-$ (<i>o</i>)
Piperonyl . . .	$(3, 4)(CH_2O_2)C_6H_3 \cdot CH_2-$
Propenyl . . .	$CH_3 \cdot CH : CH-$
Propiolyl . . .	$HC : C \cdot CO-$
Propionyl . . .	$CH_3 \cdot CH_2 \cdot CO-$
Propyl (normal) . . .	$CH_3 \cdot CH_2 \cdot CH_2-$
Propylene . . .	$-CH(CH_3) \cdot CH_2-$
Pseudoallyl . . .	<i>See</i> Iso-propenyl.
Quinolyl (from quino- line, 7 isomers) . . .	C_9H_6N-
Quinonyl . . .	<i>See</i> Quinolyl.
Salicyl . . .	(<i>o</i>) $HO \cdot C_6H_4-$
Salicylal . . .	(<i>o</i>) $HO \cdot C_6H_4 \cdot CH=$
Salicylyl . . .	(<i>o</i>) $HO \cdot C_6H_4 \cdot CO-$
Styrene . . .	$-CH(C_6H_5) \cdot CH_2-$
Styrolene . . .	<i>See</i> Styrene.
Styryl . . .	$C_6H_5 \cdot CH : CH-$
Succinamyl . . .	$H_2N \cdot CO \cdot CH_2 \cdot CH_2 \cdot CO-$
Succinyl . . .	$-OC \cdot CH_2 \cdot CH_2 \cdot CO-$
Tetradecyl . . .	$CH_3 \cdot (CH_2)_{12} \cdot CH_2-$
Thio . . .	$-S-$
Thiocarbonyl . . .	$SC=$
Thiocyano . . .	$NCS-$
Thujyl . . .	$C_{10}H_{17}-$
Thymyl (from thymol) . . .	$HO \cdot C : C(CH_3) \cdot CH : CH \cdot C(i - C_3H_7) : C-$
Toluyal (<i>o</i> , <i>m</i> , or <i>p</i>) . . .	$CH_3 \cdot C_6H_4 \cdot CO-$
<i>a</i> -Toluyal . . .	$C_6H_5 \cdot CH_2 \cdot CO-$
Tolyl (<i>o</i> , <i>m</i> , and <i>p</i>) . . .	$CH_3 \cdot C_6H_4-$
<i>a</i> -Tolyl . . .	<i>See</i> Benzyl.
Tolylene (6 isomers) . . .	$CH_3 \cdot C_6H_3=$
<i>a</i> -Tolylene . . .	<i>See</i> Benzal.
Tredcyl . . .	$CH_3 \cdot (CH_2)_{11} \cdot CH_2-$
Undecyl . . .	$CH_3 \cdot (CH_2)_9 \cdot CH_2-$
Valeryl . . .	$CH_3 \cdot (CH_2)_3 \cdot CO-$
Vanillal . . .	$(3, 4)(CH_3O)(HO) \cdot C_6H_3 \cdot CH=$
Vanilloyl . . .	$(3, 4)(CH_3O)(HO) \cdot C_6H_3 \cdot CO-$
Vanillyl . . .	$(3, 4)(CH_3O)(HO) \cdot C_6H_3 \cdot CH_2-$
Xyloyl (from xylic acid, 7 isomers) . . .	$(CH_3)_2 \cdot C_6H_3 \cdot CO-$
Xylal (9 isomers) . . .	$(CH_3)_2 \cdot C_6H_3-$
Xylylene . . .	$-H_2C \cdot C_6H_4 \cdot CH_2-$

APPENDIX II.

DETERMINATION OF PHYSICAL CONSTANTS.

Melting-point.—The purity of a solid synthetic may be determined by its melting-point, for it is well known that the presence of a foreign substance will lower the melting-point. The apparatus required is not complicated :—

A good centigrade thermometer.

A thin-walled glass tube of about 1 mm. diameter, closed at one end.

A large glass tube having a bulb at one end.

A liquid having a higher boiling-point than the melting-point of the solid, such as paraffin oil, castor oil, glycerine, etc.

A small quantity of the dried and powdered substance is introduced into the capillary tube, closed at one end. This tube is attached to the thermometer so that the substance is on the same level as the bulb containing the mercury (the rubber ring being at the top of the capillary tube and not immersed). The liquid is poured into the bulb and the thermometer bulb and tube immersed. It is held in place by a rubber cork inserted in the top. This is fitted on a metal stand and a bunsen flame placed below the bulb which is heated very gradually. When a certain temperature is reached the synthetic, if pure, melts suddenly within a range of one or two degrees. The process should be repeated

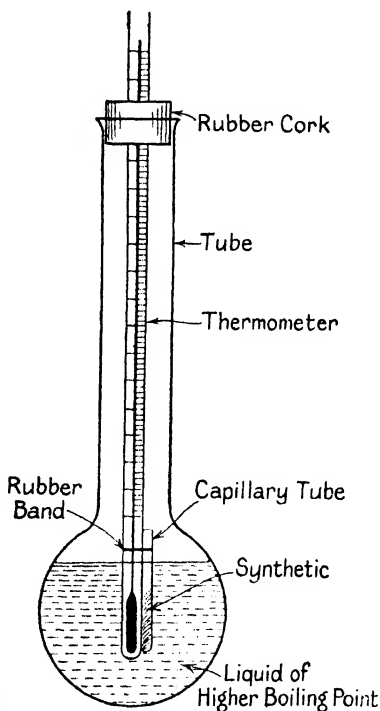


FIG. 48.—Melting-point Apparatus.

several times with fresh portions of the synthetic, and the mean temperature taken as the melting-point of the substance.

Boiling-point.—Pure synthetics have a constant and definite boiling-point when the liquid is boiled under the same pressure and similar conditions. The apparatus required for its determination is as follows:—

A centigrade thermometer.

A distilling flask with a side tube.

A condenser.

A receiving flask.

The synthetic is placed in the distilling flask and the thermometer, held by a rubber cork on the top, is placed so that the bulb is just opposite the side tube. The condenser is connected with the side tube and the receiving flask placed at the bottom orifice.

Heat is applied to the flask very gradually until the liquid boils, the vapour being carried away by the side tube and condensed. When the reading of the thermometer remains constant, the temperature is that of the boiling-point of the liquid.¹

The atmospheric pressure should be constant and

that of 760 mm. of mercury. When it is below this a correction of 0.043° is necessary or every 1 mm.

¹ When the thread of mercury extends above the cork the following correction must be made according to the formula:—

$$N(T - t) \times 0.000156,$$

where T = the apparent temperature in degrees centigrade,

t = the temperature of a second thermometer, the bulb of which is placed at half the length N above the cork,

N = the length of the thread of mercury in degrees above the vessel to T .

0.000156 = the apparent expansion of mercury in glass.

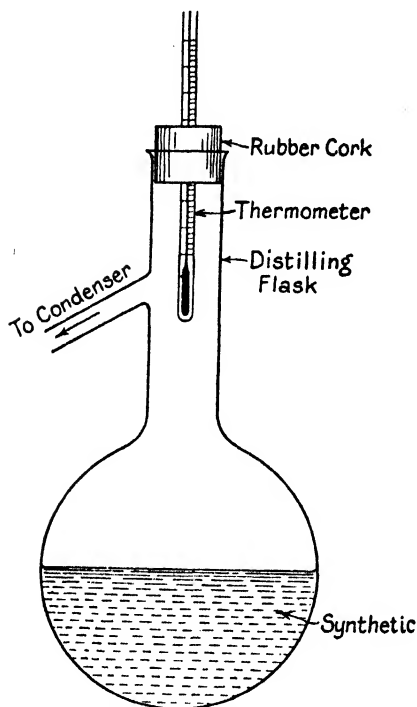


FIG. 49.—Distilling Flask for Boiling-point Determination.

Some liquids undergo decomposition near the boiling-point, and the boiling-point is therefore taken under reduced pressure and is in consequence lower. The only alteration to the apparatus is the use of a second distilling flask at the lower end of the condenser (sometimes this may be dispensed with) when the side tube is attached to a gauge and water pump.

Specific Gravity.—The density of a liquid is an important indication of its purity. It is obtained by comparing the weight of a given volume of the liquid with the weight of an equal volume of water—both at the same temperature—usually 15° C. All that is required is—

A specific gravity bottle of known tare.
A balance.

The best type of specific gravity bottle is fitted with a perforated stopper which enables the precise filling of the bottle with the liquid and with the exclusion of air bubbles. The bottle should be absolutely dry and is then filled with the liquid at the necessary temperature. The stopper is fitted and any liquid escaping from the perforation is wiped off with the dry hand. The bottle is then wiped dry and weighed. By subtracting the tare of the bottle from the total weight, the weight of the liquid is obtained.

This is repeated with distilled water at the same temperature in a perfectly dry and clean bottle.

In view of the fact that the volumes of the liquid and the water which has been weighed are equal, the specific gravity is obtained by dividing the former by the latter.

The *hydrometer* furnishes a quick way of taking the specific gravity of a liquid and dispenses with the necessity for weighing.¹

¹ Other indications of the purity of substances are obtained by taking the refractive index and the optical activity (rotation), but since a refractometer and a polarimeter are necessary and are not in the possession of the average perfumery chemist, these methods are not detailed here.

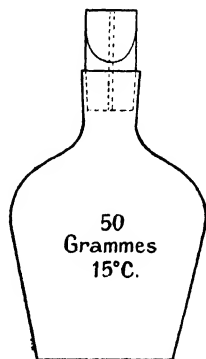


FIG. 50.—Specific Gravity Bottle.

APPENDIX.

CONVERSION TABLES.

1. Measures of weight—grams into avoirdupois.
2. Grams per kilo into grains per pound.
3. Grams per litre into grains, etc., per fluid ounce, pint, and gallon.
4. C.c. per litre into minims, etc., per fluid ounce, pint, and gallon.
5. Measures of capacity—c.c. into pints.
6. Conversion data.
7. Fineness of powders.

Measures of Weight.

- 1 gram = the weight of 1 cubic centimetre (c.c. or mill.) of water at 4° C.
- 1 grain = 0.0648 gram.
- 1 oz. (Troy) = 31.1035 grams.
- 1 lb. avoirdupois = 453.593 grams.

	Gram.	Grains.	Avoirdupois.		
Milligram . .	0.001	0.0154			
Centigram . .	0.01	0.1543			
Decigram . .	0.1	1.5432			
Gram . .	1.0	15.4323	lb.	oz.	drams
Decagram . .	10.0	154.3234	0	0	5.65
Hectogram . .	100.0	1543.2348	0	3	8.5
Kilogram . .	1000.0	15432.3488	2	3	5

Grams per Kilo (parts per 1000).

Into Grains, etc., per Pound (7000 grains).

Grams per Kilo.	Per Pound.	
	Oz.	Grains (avoir.).
1	0	7'0
2	0	14'0
3	0	21'0
4	0	28'0
5	0	35'0
6	0	42'0
7	0	49'0
8	0	56'0
9	0	63'0
10	0	70'0
20	0	140'0
30	0	210'0
40	0	280'0
50	0	350'0
60	0	420'0
70	1	52'5
80	1	122'5
90	1	192'5
100	1	262'5
200	3	87'5
300	4	350'0
400	6	175'0
500	8	—
600	9	262'5
700	11	87'5
800	12	350'0
900	14	175'0
1000	16	—

Grams per Litre.

Into Grains, etc., per Fluid Ounce, Pint, and Gallon.

Grams per Litre.	Grains per Fluid Oz.	Grains, etc., per Pint.		Grains, etc., per Gallon.			Grams per Litre
		Oz.	Grains.	Lb.	Oz.	Grains.	
1	0.43	0	8.75	0	0	70.0	1
2	0.87	0	17.50	0	0	140.0	2
3	1.31	0	26.25	0	0	210.0	3
4	1.75	0	35.00	0	0	280.0	4
5	2.18	0	43.75	0	0	350.0	5
6	2.62	0	52.50	0	0	420.0	6
7	3.06	0	61.25	0	1	52.5	7
8	3.50	0	70.00	0	1	122.5	8
9	3.93	0	78.75	0	1	192.5	9
10	4.37	0	87.50	0	1	262.5	10
20	8.75	0	175.00	0	3	87.5	20
30	13.12	0	262.50	0	4	350.0	30
40	17.50	0	350.00	0	6	175.0	40
50	21.87	1	0	0	8	0	50
60	26.25	1	87.50	0	9	262.5	60
70	30.62	1	175.00	0	11	87.5	70
80	35.00	1	262.50	0	12	350.0	80
90	39.37	1	350.00	0	14	175.0	90
100	43.75	2	0	1	0	0	100
200	87.50	4	0	2	0	0	200
300	131.25	6	0	3	0	0	300
400	175.00	8	0	4	0	0	400
500	218.75	10	0	5	0	0	500
600	262.50	12	0	6	0	0	600
700	306.25	14	0	7	0	0	700
800	350.00	16	0	8	0	0	800
900	393.75	18	0	9	0	0	900
1000	437.50	20	0	10	0	0	1000

C.c. per Litre.

Into Minims, etc., per Fluid Ounce, Pint, and Gallon.

C.c. per Litre.	Per Fluid Oz.	Per Pint.		Per Gallon.			C.c. per Litre.
	Minims.	Fluid Oz.	Minims.	Pints.	Fluid Oz.	Minims.	
1	0.48	0	9.6	0	0	76.8	1
2	0.96	0	19.2	0	0	153.6	2
3	1.44	0	28.8	0	0	230.4	3
4	1.92	0	38.4	0	0	307.2	4
5	2.40	0	48.0	0	0	384.0	5
6	2.88	0	57.6	0	0	460.8	6
7	3.36	0	67.2	0	1	57.6	7
8	3.84	0	76.8	0	1	134.4	8
9	4.32	0	86.4	0	1	211.6	9
10	4.80	0	96.0	0	1	288.0	10
20	9.60	0	192.0	0	3	96.0	20
30	14.40	0	288.0	0	4	384.0	30
40	19.20	0	384.0	0	6	192.0	40
50	24.00	1	0	0	8	0	50
60	28.80	1	96.0	0	9	288.0	60
70	33.60	1	192.0	0	11	96.0	70
80	38.40	1	288.0	0	12	384.0	80
90	43.20	1	384.0	0	14	192.0	90
100	48.00	2	0	0	16	0	100
200	96.00	4	0	1	12	0	200
300	144.00	6	0	2	8	0	300
400	192.00	8	0	3	4	0	400
500	240.00	10	0	4	0	0	500
600	288.00	12	0	4	16	0	600
700	336.00	14	0	5	12	0	700
800	384.00	16	0	6	8	0	800
900	432.00	18	0	7	4	0	900
1000	480.00	20	0	8	0	0	1000

Measures of Capacity.

1 litre = 1 cubic decimetre = 35.214 fluid ounces.

1 gallon = 4.54596 litres.

	Litres.	Pints.
Millilitre (c.c. or mil.) .	0.001	0.0017
Centilitre . . .	0.01	0.0176
Decilitre . . .	0.1	0.1760
Litre	1.0	1.7607
Decalitre	10.0	17.6077
Hectolitre	100.0	176.0773
Kilolitre	1000.0	1760.7734

Conversion Data.Grams \times 15.432 = grains.Grains \times 0.0648 = grams.Ounces \times 28.349 = grams.Pints \times 567.936 = cubic centimetres.Gallons \times 4.548 = litres.Litres \times 0.22 = gallons.
$$\frac{\text{Grains per gallon}}{0.7} = \text{parts per 100,000.}$$
Parts per 100,000 \times 0.7 = grains per gallon.
$$\text{Degrees Twaddell} = \frac{1000 (\text{Specific Gravity}) - 1000}{5}$$

$$\text{Specific Gravity} = \frac{(\text{Degrees Twaddell} \times 5) + 1000}{1000}$$
Fineness of Powders.*Diameter of Particles Passing through a*

No. 40 mesh sieve is less than 0.38 millimetre.

" 50	"	"	0.28	"
" 60	"	"	0.23	"
" 80	"	"	0.17	"
" 100	"	"	0.14	"
" 120	"	"	0.12	"
" 150	"	"	0.09	"
" 200	"	"	0.07	"

APPENDIX IV.

STANDARD PACKAGES.

These are given to enable buyers to purchase original cases and thus obtain more economical quotations.

Aniseed. Cases containing $4 \times 16\frac{2}{3}$ lbs. in leads, occasionally tins and drums.

Bergamot. Cases containing 2 or 4 coppers or tins each weighing 25 lbs. or 28 lbs. net.

Bois de Rose. Drums of 180 kilos net (apx. 400 lbs.).

Cassia—as Aniseed, but almost always leads only.

Citronella—Ceylon. Drums $6\frac{1}{2}$ or 10 cwt. net.

Citronella—Java. Drums 5 cwt. net.

Lemon—as Bergamot.

Lemon-grass. Drums $3\frac{1}{4}$ cwt., $6\frac{1}{2}$ cwt., and 10 cwt.

Limes—West Indian. Cases of 2×35 lbs. in tins.

Orange—as Bergamot. Californian, in drums and 20 lb. tins.

Patchouli—Singapore. Cases containing 2×20 lb. drums.

Petitgrain—Paraguay. Cases containing 8×5 kilo tins (about 90 lbs.).

Sandalwood—East Indian. Cases 6×10 lb. tins.

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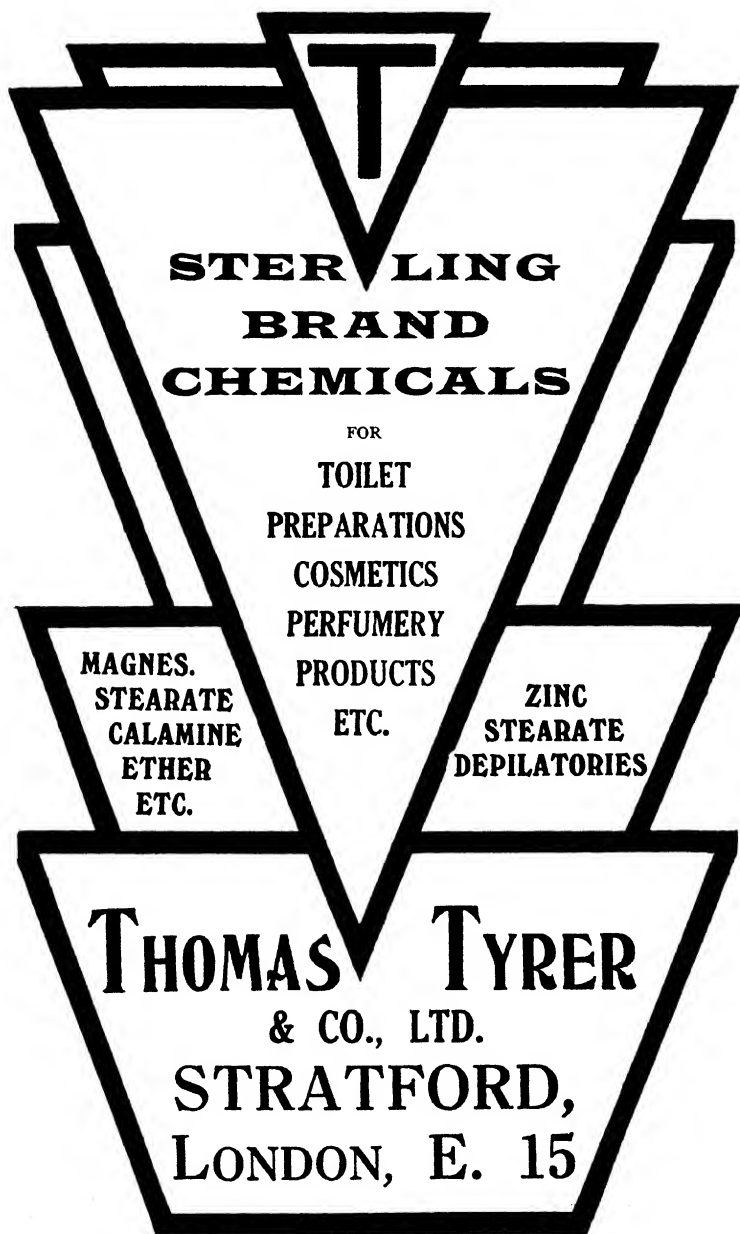
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